FLIGHT and AIRCRAFT ENGINEER

Editorial Director G. GEOFFREY SMITH, M.B.E.
Editor - - C. M. POULSEN
Assistant Editor - MAURICE A. SMITH, D.F.C. (WING CDR., R.A.F.V.R.)
Art Editor - - JOHN YOXALL

First Aeronautical Weekly in the World : Founded 1909

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams : Flightpres, Sedist, London. Telephone : Waterloo 3333 (50 lines.)

COVENTRY : 8 - 10, CORPORATION ST. *Telegrams :* Autocar, Coventry. *Telephone :* Coventry 5210.
BIRMINGHAM, 2 : KING EDWARD HOUSE, NEW STREET. *Telegrams :* Autopress, Birmingham. *Telephone :* Midland 7191 (7 lines).
MANCHESTER, 3 : 260, DEANSGATE. *Telegrams :* Iliffe, Manchester. *Telephone :* Blackfriars 4412.
GLASGOW, C.2 : 26B, RENFIELD ST. *Telegrams :* Iliffe, Glasgow. *Telephone :* Central 4857

SUBSCRIPTION RATES : Home and Abroad : Year, £3 1 0; 6 months, £1 10 6.

Registered at the G.P.O. as a Newspaper

No. 1984. Vol. LI. January 2nd, 1947 Thursdays, One Shilling.

The Outlook

The Old Year—

"HISTORY is bunk" is a saying ascribed, rightly or wrongly, to Mr. Henry Ford. Whatever may be the correctness or otherwise of the alleged parentage, one is inclined to believe that the originator meant that there is little profit in looking back, and that to make progress one must look forward. That is, of course, undeniable, but it is equally true that unless one looks back and profits by one's mistakes, progress is likely to be erratic. The Royal Navy takes a very realistic view by allowing a man to make one big mistake but no more. The man who makes the same mistake twice is obviously incapable of profiting by experience or, in other words, fails to take into account the lessons of his past history.

It is the same with groups of individuals, from small communities to large communities and whole nations. The closing of a year and the opening of another is a good time for taking stock, not only in order to profit by the mistakes made, but also to discover whether the innovations begun during the past year promise to lead us in the right direction towards the specified goal.

For British aviation the year 1946 must be set down as one of very considerable achievement. One particular aspect stands out as significant and full of promise for the future. The aircraft industry has, in spite of many and great difficulties, managed its conversion to peace production with remarkable smoothness and speed. At the same time as firms have changed from military to civil aircraft types, many quite revolutionary ideas have been tried out and have in turn led others yet to be tested and proved. Records are the most obvious signs of progress, and at the upper end of the speed scale we can claim with pride the Meteor's attested 616 m.p.h.

There are, however, other and less spectacular achievements on the credit side of British aviation. They are recorded elsewhere in this issue and represent good sound solid progress. Aircraft types of great promise have appeared and, in both aircraft and power-plant fields the British names stand very high in the world. The success already achieved of the export drive so boldly undertaken by the Society of British Aircraft Constructors bears testimony to the fact.

It is to be regretted that the political aspect has not managed to keep pace with the technical. That was to be expected. In technical matters we have only ourselves to consider. As soon as politics, especially international politics, enter the arena the picture changes. Yet here also we have managed to attain something—the Bermuda agreement, for example. Still in the international field, but of a technical character, satisfaction must be felt with the work done by P.I.C.A.O. The progress made by that body is very praiseworthy, even if many problems still await solution.

Altogether the year 1946, although it might have been better, could very easily have been so much worse.

—And the New

WITH much on the credit side of the ledger, for which we should be duly thankful, there are unfortunately a good many items on the debit side which are far from satisfactory. The most disquieting among these is the great number of lives lost in air accidents. During the war, life came to be held cheap, as is the way of wars. But in a world which will, we hope, be at peace some day, such disasters must not be allowed to happen.

There is no single cause of all these crashes. They are due to a variety of circumstances, but on the whole they may, perhaps, be summed up in the homely phrase that we are running before we have learned to walk. We pride ourselves on the great speeds attained, on the "records" set up between one place on the globe and another, but the sad fact remains that we have not learned how to fly our commercial aircraft safely at 100 m.p.h. While we do not for one moment suggest that the striving for speed should cease, we do plead for more

attention to be given to problems at the other end of the speed scale. They appear to be neglected. We would personally much rather see a handsome reward offered to the man who succeeds in bringing stalling speeds of fast aircraft down to 60 m.p.h. than to the first one to penetrate the compressibility wall. The former would be a very unspectacular achievement, but how much more useful to mankind.

High speed is not, of course, the only cause of accidents. Bad weather is a fruitful source of trouble and, at the best causes long delays. But high cruising speeds presuppose high wing loadings which, in turn necessitate long take-off and landing runs and require runways of fantastic lengths. By demanding more and more of the aircraft crews we manage to operate with these wing loadings, and so long as all goes well we delude ourselves that we are "getting away with it." The cold hard fact is that we are not. We are merely taking bigger and bigger chances.

Given full use of available navigational aids—and their adoption is delayed by political rather than by technical considerations—the dangers of flying are confined almost entirely to the start and finish of a flight. Engines are so reliable nowadays that forced landings from this cause are rare occurrences. If, therefore, we could manage to improve conditions at the low end of the speed scale, we should have gone a long way towards making commercial flying safe.

Aviation circles of the world would do well to make it a New Year resolution that improvement of slow-flying characteristics be given priority in the year's programmes. Progress in that direction would do more towards establishing confidence than any other single item of the many needing attention.

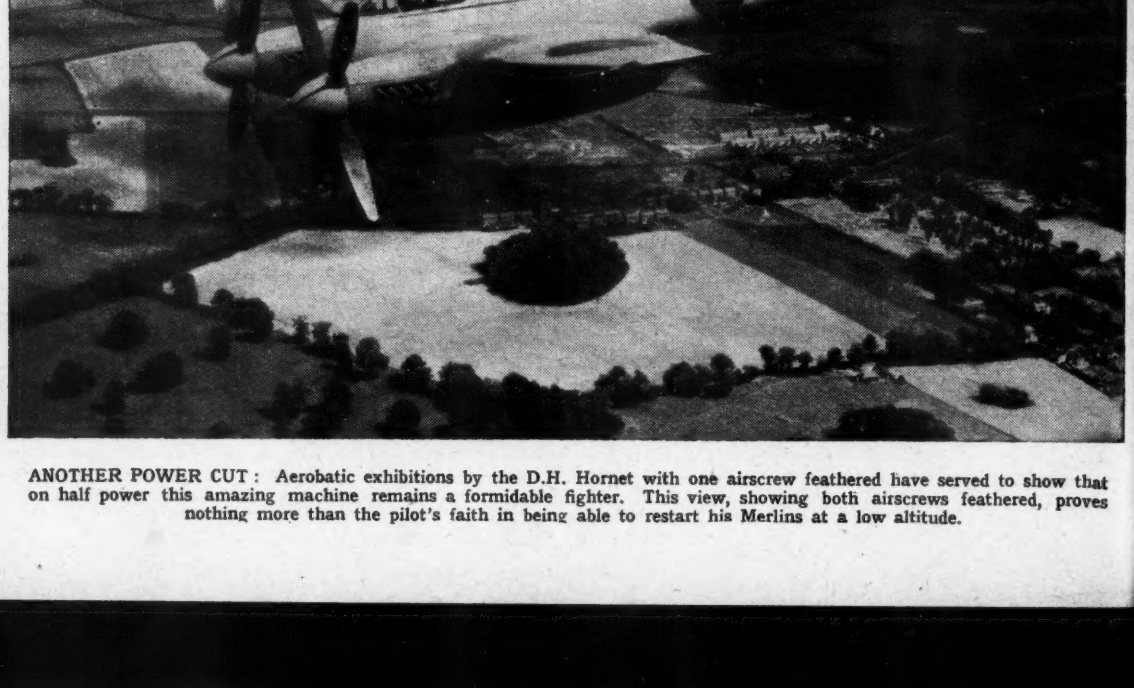
CONTENTS

Outlook	1
Duplex Airscrews	3
Naval Aircraft	8
The Old Year	11
Another Amphibian	17
Metrovick F5	18
Here and There	19
Civil Aviation News	20
Correspondence	23
Service Aviation	24

The B-licence Situation

A DIFFERENT aspect of safe flying, but obviously closely related to it, is the question of overhauling the present B-licence qualifications. We published on December 5th last year a very serious and thought-provoking article entitled "Airline Pilot." From this it is obvious that existing regulations are badly in need of revision, having been rendered obsolete by technical developments that have taken place since the regulations were drafted.

That there ought to be more than one category of licence has become obvious. A correspondent calls attention, in this issue, to the case of taxi and charter operation, and pleads for differentiation in the qualities demanded in this field and in that of airline operation. But even in air transport there is so great a variety in the various routes that special qualifications are essential to some which would be superfluous on others. It is not necessarily a case of one grade being "higher" than the other—merely different.



ANOTHER POWER CUT: Aerobatic exhibitions by the D.H. Hornet with one airscrew feathered have served to show that on half power this amazing machine remains a formidable fighter. This view, showing both airscrews feathered, proves nothing more than the pilot's faith in being able to restart his Merlins at a low altitude.

DUPLEX AIRSCREWS

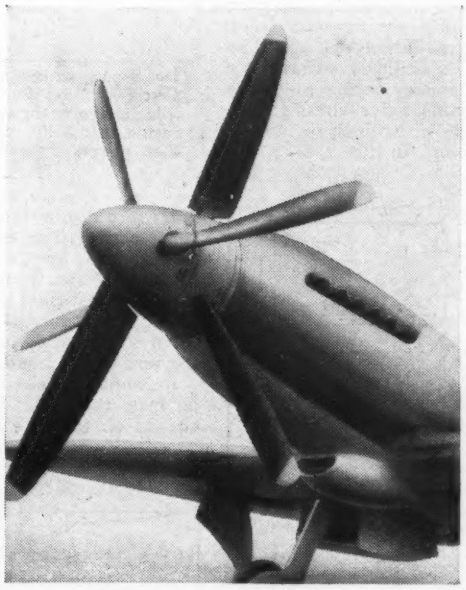
Part II. An Analysis of the Rotol Hydraulic "Contra Prop"

By C. B. BAILEY-WATSON

As the matter of definition in terminology referring to airscrews seems to occasion a certain amount of misunderstanding over what is, essentially, a straightforward issue, we might with advantage amplify the definitions given last week.

A contra-rotating airscrew is, in effect, a single airscrew the thrust area of which is divided into two banks of blades arranged to rotate in opposite directions. But since both blade banks are simultaneously controlled for constant-speeding, feathering and braking, and one blade bank cannot be operated independently of the other, it is logical to assess the airscrew in the singular case. A contra-rotating airscrew is most often driven by one engine, but as may be seen in the layout diagrams, it can be driven by two engines through clutch couplings. If one engine should fail, it is de-clutched and the remaining engine alone then drives the airscrew.

Conversely, coaxial airscrews are entirely separate units which are mounted in tandem on coaxial shafts. Each airscrew is driven by its own engine and is independently controlled for all its functions. That is to say, the speed of rotation *can* be different—although in practice it is not so, because of vibrational complications—and one airscrew may be stopped and feathered whilst the other continues to operate. The method of driving may vary; in the case of the Bristol 167 each engine of the four pairs of Centaurus which power the aircraft drives its airscrew through reduction gears housed in a box common to each pair of engines. However, on the Macchi-Castoldi racing seaplane a different system was employed: the two Fiat engines were mounted in tandem with the transmission taken from between them up to coaxial shafts passing forward between the cylinder banks of the front engine and so to the individual airscrews. Other possible drive layouts are illustrated in the diagrams on the next page.



The Rotol six-blade contra-rotating airscrew fitted to the Rolls-Royce Griffon 85 engine of a Spitfire 22.

We ought, too, perhaps, to deal with the subject of "handed" airscrews, since this is a form of contra-rotation. The case is exemplified by the de Havilland Hornet and Lockheed Lightning, both of these being twin-engined aircraft with each engine carrying and driving its own airscrew. The airscrews are, however, arranged to rotate in opposite directions in order to take advantage of various benefits made available by this system. As may be seen in the illustrations, the Hornet airscrews rotate inwards at the top, whilst the Lightning airscrews rotate outwards. Rotation in this instance is determined by aerodynamic considerations.

The Rotol airscrew can briefly be described as consisting of two banks of three blades each, both hubs being of simliar basic design and construction, actuated by the conventional Rotol hydraulic system employing a stationary piston and sliding cylinder. The pitch-change motion for the rear bank of blades is transferred from the front bank through the medium of a translational bearing unit. Contra-rotation is achieved by the interposition of an idler pinion in one half of the reduction gear, the normal direction of rotation being left-hand for the front bank of blades and right-hand for the rear.

We have mentioned that the singular case is used in referring to a contra-rotating airscrew, as distinct from coaxial airscrews where the plural case is correct. This is exemplified by the particular airscrew we are considering; the two blade banks are driven by one engine, constant-speeding is controlled by one c.s. governor unit, and the pitch change motion is actuated by a single piston and cylinder assembly.

IN last week's issue we reviewed the power installation of the Bristol 167 Brabazon I, taking it as an excellent example of coaxial airscrew application. To complement this, and to provide the remainder of our survey of duplex airscrews, we this week deal with the Rotol six-blade hydraulic contra-rotating airscrew as used with the Rolls-Royce Griffon 85 engine to power the Spitfire 22.

The Hubs

Since the basic design and structure of each hub is similar, we can make the description general. Each of the airscrew blades, which are solid duralumin forgings, is screwed into a steel blade adaptor on which a Timken taper bearing is anchored between two buttress-threaded ring nuts. This assembly is secured in the hub barrel, with the centre race of the taper bearing held against a shoulder-flange inside the barrel by a buttress-threaded retaining nut screwed into the barrel mouth. The design has the merit of being smaller, lighter and neater than the original form of blade housing, the improvement being directly attributable to the employment of a single duplex bearing in place of the multiple bearing stacks previously used to accommodate centrifugal-thrust and journal loads.

The three barrels which make up the blade-carrying part of each hub are made in an integral unit; this is bolted to an internally splined driving centre which mates with the airscrew shaft for the transmission of torque. Static and thrust loads are taken upon cone seatings in the conventional manner, the hub being secured by means of a retaining ring nut screwed on the end of the shaft and, in so doing, pinching-up hub and cones.

Inside the inner airscrew shaft is a distributor unit to which control oil from the constant-speed unit is ducted. Into this distributor are screwed two coaxial tubes which, at their forward ends, carry the piston; this latter component is enclosed by a large-diameter shallow cylinder supported by a hollow stalk housed inside the airscrew shaft and surrounding the oil tubes. Pressure oil

DUPLEX AIRSCREWS

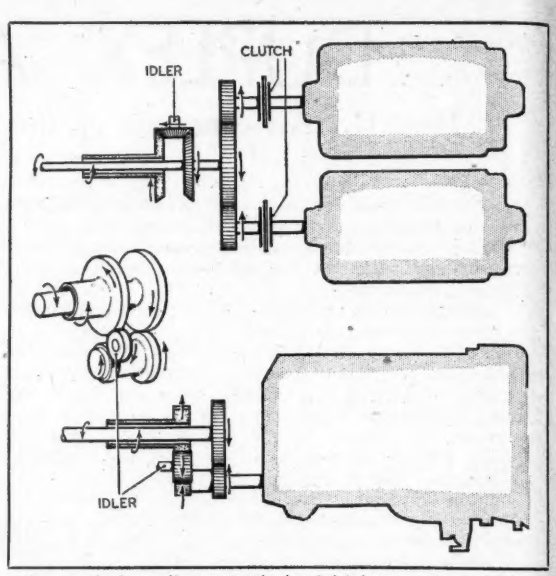
from the c.s.u. is fed via the oil tubes to the forward side of the piston for coarsening blade pitch, and to the rear of the piston for fining pitch, the oil pressure reacting against the piston area and thus causing the cylinder to move forward or rearward to effect pitch change.

Transmission between cylinder and blades is by means of an articulated linkage whereby the linear motion of the cylinder is converted to rotary motion of the blades.

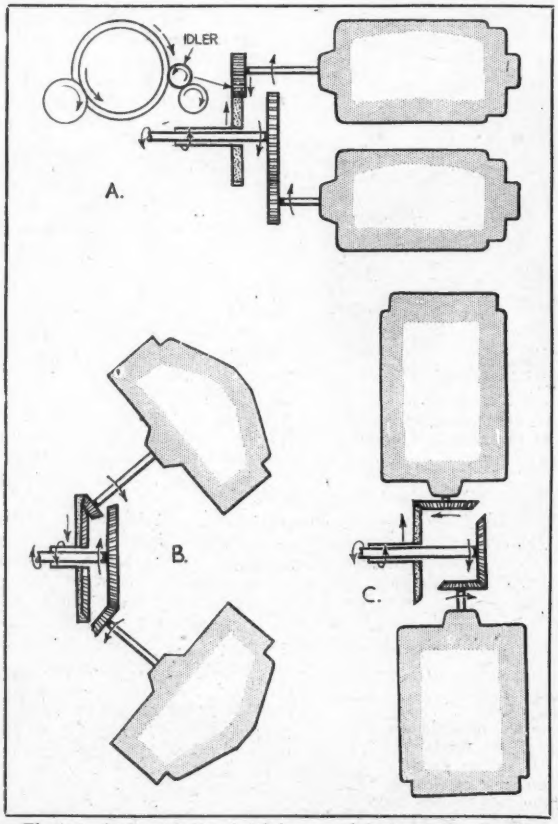
Pitch Change

The articulated linkage for the front bank of blades is a simple link bolted to the cylinder and sliding in guide sleeves through the front and rear walls of the hub. The central part of the link is swollen and bored to accommodate a sliding Tufnol block, itself recessed to accommodate an operating pin anchored on the base of the blade; thus, as the piston moves the link fore and aft, the Tufnol block can slide laterally in the link to conform with the arcuate motion of the operating pin.

The front blade links are tapped at their rear ends for receiving a connecting bolt which picks up lugs on a sleeve secured to the inner race of the translation bearing. The outer race of this bearing is correspondingly enclosed by a housing to which the rear blade operating links are articulated. Also embodied in this outer housing is a driving joint in the form of a yoke with which registers a driving pin attached to the rear hub. In this manner, the rear blade links are relieved of the duty of rotating the outer race of the translator bearing, the transmission loads being conveyed solely through the pin; however, transmission loads for the inner race are carried by the bearing links of the front hub, a duty which they can well afford since the cantilever is short and thus the bending moment small. The translation bearing is enclosed within a truncated cone housing attached to an annular plate bolted on the rear of the front hub.

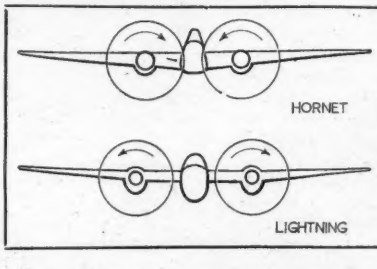


Two typical yet diverse methods of driving a contra-rotating airscrew. Top: By two parallel engines driving compound reduction gears through clutch couplings. Bottom: By one engine, as in Griffon and Merlin installations, where the crankshaft powers a double pinion and an idler is used to give contra-rotation.



Three typical methods of driving coaxial airscrews. A: By parallel engines driving through spur reduction gears, one incorporating an idler pinion. B: By raked engines driving bevel reduction gears, one an internal type. This scheme is used for the Bristol 167. C: By opposed engines driving right-angle simple bevel reduction gears.

Reference has already been made to the supply of control oil from the constant-speed unit to the cylinder via the coaxial oil tubes to effect pitch change, but it might be worth while in conclusion to review the constant-speed operation of the airscrew.



Examples of handed airscrews. Directions of rotation are determined by aerodynamic effects on the aircraft.

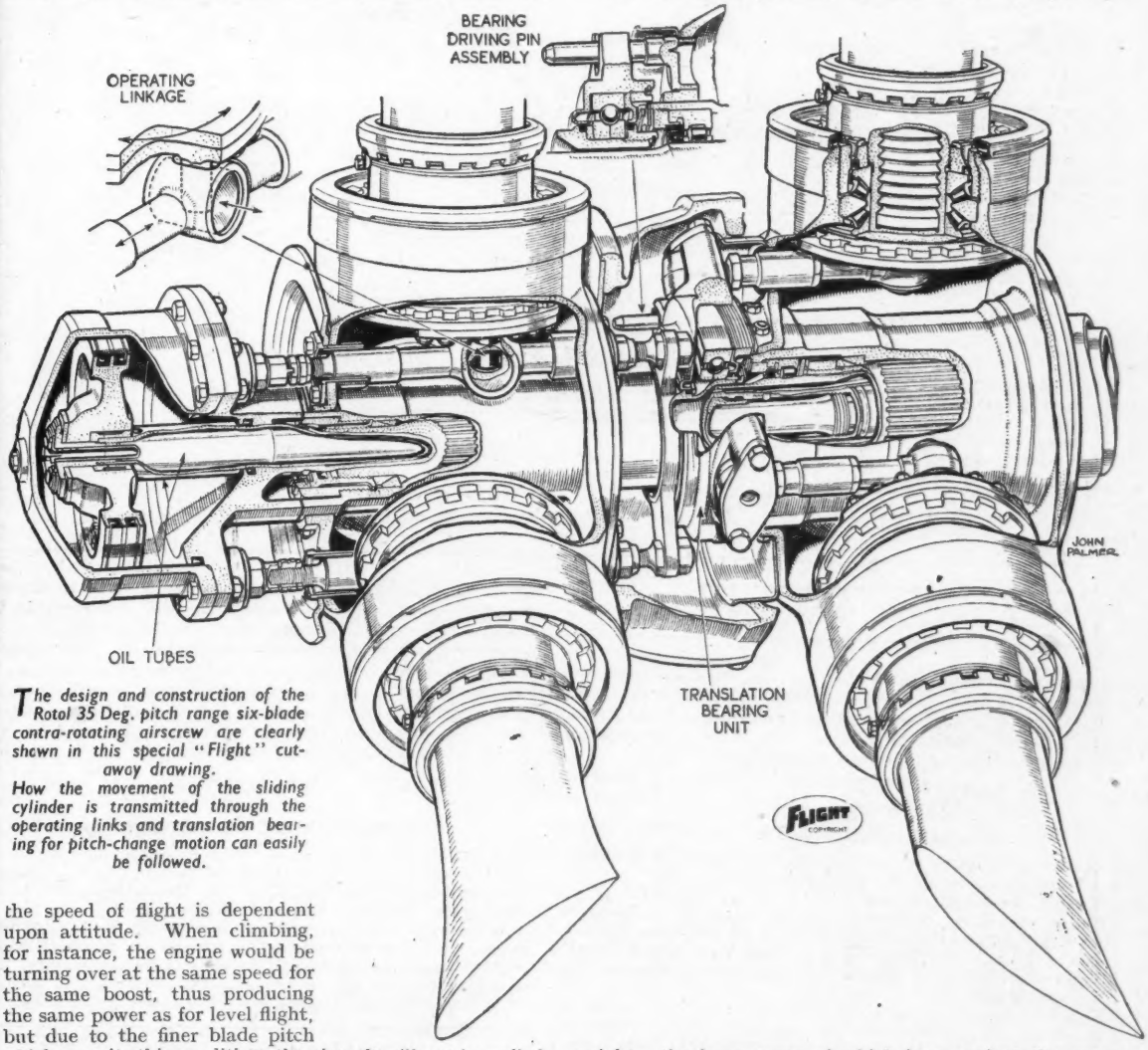
First, one must bear clearly in mind that the pilot has two major engine controls, (i) the throttle, which controls the degree of supercharge given to the engine and has only an indirect bearing on the engine r.p.m.; and (ii) the speed control which, through the medium of the constant-speed unit, by regulating the pitch of the airscrew blades, determines the speed at which the engine shall run, irrespective, within limits, of the load and likewise of the boost pressure.

Let us consider an example: an aircraft is flying straight and level at normal cruise conditions; the boost, we will assume to be plus 6 lb/sq in and the engine r.p.m. steady at 2,100. The pitch angles of the blades at these values we will take as being 40 deg. for the front blades and 38 deg. for the rear blades, the latter having a relatively finer basic pitch setting to compensate for their having to operate in the helical wash from the front blades.

The pilot then decides to climb a few thousand feet;

load on the engine is at once increased and thus the r.p.m. tend to fall, and (although the boost value does not change) immediately this happens the constant-speed unit regulates the blade pitch to finer angles, say 30 and 28 deg., allowing the engine to speed-up to its original figure of 2,100 r.p.m.

On the other hand, should the pilot start diving, the load on the engine is relieved, the "revs" tend to soar and the blade pitch is consequently coarsened until the engine r.p.m. are brought back to their selected figure. As the time-lag between engine r.p.m. change and corrective action is very small, engine speed and boost pressure remain virtually constant. The actual power output of the engine is thus maintained at a determined value, irrespective of the attitude of the machine, although naturally the speed of flight is dependent upon attitude. When climbing, for instance, the engine would be turning over at the same speed for the same boost, thus producing the same power as for level flight, but due to the finer blade pitch which permits this condition, the aircraft will not be pulled through the air for so great a distance per revolution of the airscrew, and thus the climbing speed will be lower.

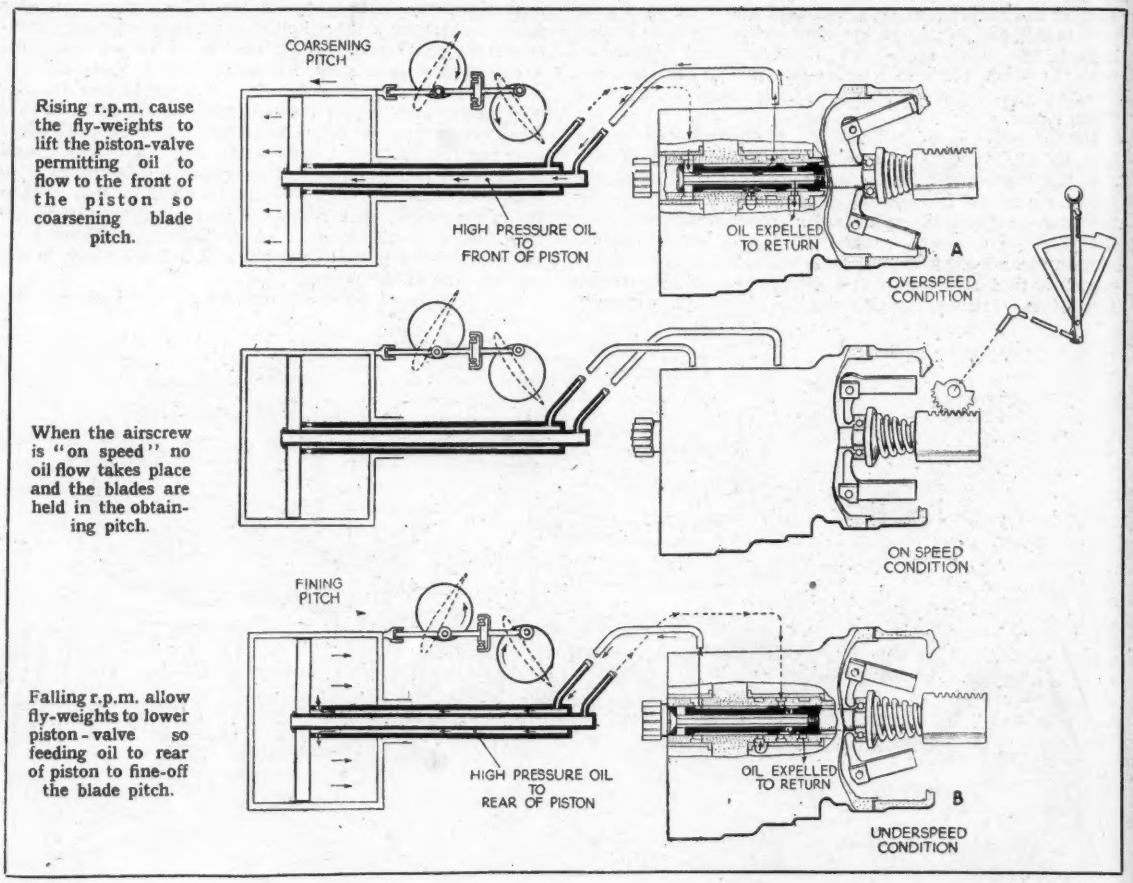


The design and construction of the Rotol 35 Deg. pitch range six-blade contra-rotating airscrew are clearly shown in this special "Flight" cut-away drawing.
How the movement of the sliding cylinder is transmitted through the operating links and translation bearing for pitch-change motion can easily be followed.

Constant-speed Unit

The constant-speed unit is mounted on and driven by the engine, and is composed of three main elements, viz., a gear-type oil pump, a centrifugal governor, and a piston valve, all of which are housed in a three-part casing. The gear-type pump is also the drive for the centrifugal governor and comprises a driving gear mounted on a long hollow shaft, one end of which is splined to transmit the drive from the engine. Meshing with the driving gear is an idler gear mounted on a short hollow shaft incorporating a non-return valve through which engine oil enters the unit. These gear wheels form the pump which feeds oil, via ducts in the casing, into the interior of the hollow driving-gear shaft, from which two outlets give access to the oil pipes connecting to the airscrew tubes. Inside the hollow gear shaft is the piston valve which has lands upon it and is moved by the centrifugal governor, so determining to which oil tube the high-pressure oil shall be fed. When the piston valve is in a central position both outlets are blanked-off by the lands, and the high-pressure oil from the pump is by-passed back through a relief valve to the suction side of the pump.

The centrifugal governor consists of two L-shaped fly-weights, the lower arms of which bear against the outer race of a ball bearing mounted on the end of the piston valve. On the other side of the ball bearing is a flange against which bears a coil spring to compensate the centrifugal movement of the fly-weights. Above the spring is a sleeve along which are cut racking teeth to mesh with a toothed segment controlled from the pilot's cockpit. Thus, according to the position to which the segment is turned, the tension of the coil spring is either lessened or increased in order to balance the centrifugal moment of the fly-weights, and so determine the position of the piston valve and the consequent distribution of the oil to the


Rising r.p.m. cause the fly-weights to lift the piston-valve permitting oil to flow to the front of the piston so coarsening blade pitch.
COARSENING PITCH
HIGH PRESSURE OIL TO FRONT OF PISTON
OIL EXPELLED TO RETURN
A
OVERSPEED CONDITION
When the airscrew is "on speed" no oil flow takes place and the blades are held in the obtaining pitch.
ON SPEED CONDITION
Falling r.p.m. allow fly-weights to lower piston-valve so feeding oil to rear of piston to fine-off the blade pitch.
FINING PITCH
HIGH PRESSURE OIL TO REAR OF PISTON
OIL EXPELLED TO RETURN
B
UNDERSPEED CONDITION

DUPLEX AIRSCREWS

airscrew oil tubes. Inside the racked sleeve a further coil spring is housed, the object of this being to ensure that the sleeve is kept in the position for normal cruising r.p.m. should the control from the cockpit be shot away or become inadvertently disconnected.

The airscrew we have dealt with is not a feathering type, since this quality is not necessary with a single-engined aircraft. Feathering types are, however, very similar, the main difference being in the provision of a longer cylinder to accommodate the increased pitch range. Extra movement of the pilot's control into the feathering position moves the c.s.u. piston valve to the positive coarse-pitch position, and a separate, electrically-driven high-output pump feeds oil to the c.s.u. whence it is delivered to the airscrew to effect feathering movement of the blades.

D.H. "OVER-TWENTY" PARTY

NINETEEN more people who have served the de Havilland Enterprise for twenty years were initiated into the Over-Twenty Fellowship at its annual party at Hatfield on December 20th. The parent company formed by Sir Geoffrey de Havilland and the executive team of the old Aircraft Manufacturing Co., Ltd., after the first Great War, is now twenty years old, and 106 of its members have been admitted to this Fellowship since it was originated in 1940.

It was considered that Major Frank Halford and those of his staff who have been engaged for twenty years on de Havilland work also qualified for membership as from 1926, the year in which he began the design of the first Gipsy engine. This year's gathering was made particularly cheerful, therefore, by the initiation of Major Frank Halford and Mr. John Brodie who has been at his right hand since an even earlier date.

Another director of the de Havilland Engine Company, who for all his youth now completes twenty years of service, is Mr. Hugh Buckingham. The others initiated were: Mr. F. W. Amos, Mr. L. T. Boreham, Mr. G. N. Cross, Miss E. D. Creamer, Mr. M. H. Eagle, Mr. A. W. Hunt, Mr. H. J. Heading, Mr. H. R. Hooper, Mr. T. E. Johnson, Mr. W. F. King, Mr. H. Neale, Mr. R. J. Nixon, Mr. R. I. Tugsley, Wing Cdr. C. A. Pike. Mr. J. E. Parnell, and Mr. T. Radford.

"SAMOPOMOC LOTNICZA"

INTRODUCING the Polish Air Force Association (*Samopomoc Lotnicza*) at a gathering in the headquarters at 14, Collingham Gardens, S.W.5, Grp. Capt. W. Makowski, C.B.E., explained the aims and objects of the Association.

In brief the P.A.F.A. has been formed—on the lines of the Royal Air Force Association—to prevent its members (now about 8,000) from becoming a liability to the community. A registered war charity, the Association is entitled to accept donations, but understanding is a more urgent requirement.

FORTHCOMING EVENTS

Jan. 3rd.—I.Mech.E.: "The Development of Aircraft Hydraulic Machinery," H. G. Conway, S. M. Parker, and D. A. L. Robson.
Jan. 4th.—R.Ae.S. Reading: Annual general meeting.
Jan. 4th.—British Interplanetary Society: "The Energy and Stability of Atomic Nuclei," L. R. Shepherd.
Jan. 6th.—R.Ae.S. Medway: "Design of a Two-seater Sailplane," F. M. Reynolds.
Jan. 7th.—R.Ae.S. Belfast: "Gliding," Professor Hill.
Jan. 7th.—R.Ae.S. Bristol: Brains Trust, with Capt. L. Laurence Pritchard as Question-master.
Jan. 8th.—R.Ae.S. Southampton: "Elementary Metallurgy of Aircraft Materials," A. Black.
Jan. 9th.—"Aerotech" Flying Club, No. 1: "Naval Aviation," R. G. Worcester.
Jan. 10th.—I.Mech.E.: "F2 Development and Shock Wave Investigation at Metro-Vick." Dr. Smith and K. Todd.

WE print above a selection from the large number of attractive Christmas cards and calendars received from friends at home and abroad. "Flight" gratefully acknowledges these symbols of goodwill, and wishes all readers health, happiness and prosperity in the coming year.

Naval Aircraft

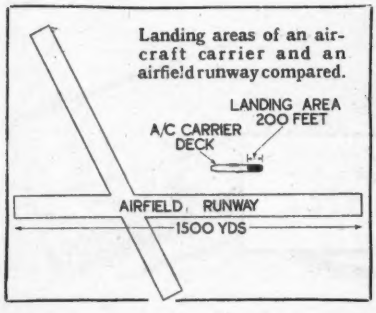
Design Requirements Discussed by Supermarine Technical Staff

LECTURING before the Southampton Branch of the Royal Aeronautical Society on December 11th, Mr. A. N. Clifton, M.B.E., B.Sc., F.R.Ae.S., chief of Vickers-Armstrongs (Supermarine) Technical Office, outlined the development of naval aircraft and explained something of the technical requirements in modern machines for naval use.

Naval aircraft design, he said, was really ordinary aircraft design made more difficult. The first handicap was the severity of take-off requirements. Although a certain amount of wind due to the ship's speed could be relied upon, long runs were out of the question and catapult spools and accelerator hooks must be provided and the aircraft must have the necessary strength to withstand the added forces imposed. Provision for rocket accelerating gear must also be made. Control characteristics and view must be specially studied and undercarriage shock absorption and rebound damping of a high order were necessary. An arrester hook and an airframe suitably strengthened for this attachment were other requirements. Radio equipment for naval use was more complicated and heavier than that required on landplanes and provision for wing folding and restrictions on dimensions were necessary.

To indicate the increase in weight necessary, Mr. Clifton gave an estimate for a fighter, showing that the additional weight for a machine of approximately 10,000lb was at least 450lb made up as follows:—

Accelerator hooks and provision for RATOG	50lb.
Arrester hook	60lb.
Extra radio	30lb.
Folding wings, slinging and lashing points	160lb.
Longer stroke undercarriage..	40lb.
Provision for oil heating, fuel draining, etc.	5lb.
	345lb.
Extra structure weight at 30 per cent	105lb.
TOTAL INCREASE ..	450lb.

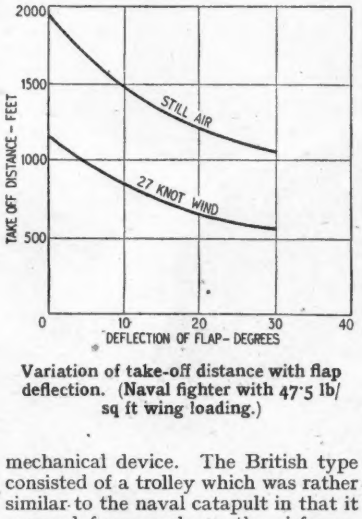


Landing areas of an aircraft carrier and an airfield runway compared.

Examining the take-off question in detail, Mr. Clifton dealt first with the normal take-off, using engine power alone. Bearing in mind that more than half the deck might be required for aircraft landing on, he said, this was only possible under favourable conditions. Partially lowered flaps were essential and a contra-rotating airscrew, which eliminated swing, was desirable.

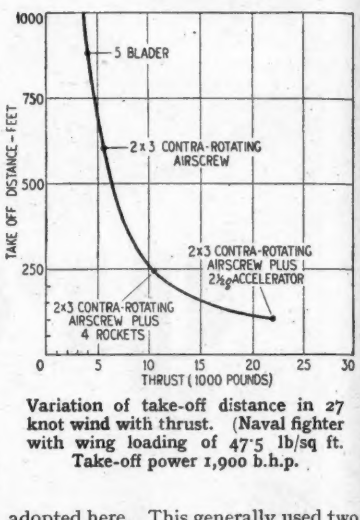
Under less favourable conditions rockets could be used for acceleration. These were carried in jettisonable containers and delivered their thrust approximately through the C.G. in side elevation. The standard rocket gave a thrust of 1,200lb for four seconds and weighed 66lb, and a container for two rockets weighed 50lb. Four rockets might be carried on a fighter to attain a 500-ft run in still air, or a 250-ft run against a 20-knot wind. This worked out at an average acceleration of about 1 G, of which ½ G might be provided by the engine.

Finally there was the accelerator, a mechanical device. The British type consisted of a trolley which was rather similar to the naval catapult in that it engaged four spools on the airframe. The forward attachments supplied the thrust and floated vertically while the rear ones held up the tail. The trolley was hauled by a rope running below a slot in the deck and the motive power was compressed air or cordite. With a maximum acceleration of about 2½ G (or a mean acceleration of 1¾ G) plus airscrew thrust over a distance of 100 ft the speed at the end was about 60 knots, relative to the ship. To this speed could be added an allowance of 20 knots for the wind speed over the deck, giving a total airspeed of 80 knots.



Variation of take-off distance with flap deflection. (Naval fighter with 47·5 lb/sq ft wing loading.)

A simpler method was developed by the U.S. Navy and had since been adopted here. This generally used two hooks on the aircraft with a strap to engage these, and a claw projecting through a slot in the deck and propelled by the accelerating mechanism. The aircraft ran on its own main and tail wheels and at the end of the run the cable was left behind and fell off the hooks. The loads on the undercarriage were fairly severe though generally speaking not severe enough to call for increased strength. These loads were due to the downward slope of the cable, and resulted in the machine running along on nearly flat tyres. The cable direction was carefully selected to pass just below the C.G. to avoid nosing over and too great a tail-wheel load. The advantages of this method were a minimum of gear above deck, quickness in operation (because no trolleys had to be lined up and engaged) and simpler and lighter attachments on the aircraft.



Variation of take-off distance in 27 knot wind with thrust. (Naval fighter with wing loading of 47·5 lb/sq ft. Take-off power 1,900 b.h.p.

Launching Rate

An essential requirement for take-off was a high rate of launching. For one thing the aircraft might be wanted in a hurry, and secondly the carrier might have to lose station relative to accompanying ships due to the necessity to steam into wind. Under favourable conditions, a squadron of twelve aircraft could be launched by acceleration in about 10 minutes. In that time the remainder of the Fleet might be 7 or 8 miles ahead.

Landing-on was a different matter altogether. It was a hazardous process calling for a high degree of co-ordinated skill on the part of the pilot and the "batsman" directing him. In the air perfect control was essential, and once on the deck the aircraft must not bounce. In the latter respect aero-

NAVAL AIRCRAFT

dynamic and undercarriage characteristics each played a part.

On the normal type of single-engined machine the view was rarely good enough to permit the approach to be straight and it therefore had to be made on a turn so that the ship was in sight all the time. The height was chosen so that the final approach was down a path inclined at about 4½ deg to the horizontal. Viewed from the ship's deck the angle appeared steeper due to the ship's motion. A smaller angle—less than, say, 3½ deg—for the approach path would result in the aircraft encountering the disturbed air of the ship's wake, while more than about 6 deg would result in difficulty in flattening out and too much vertical velocity. To obtain the desired approach path meant using about 1/5 max h.p.

The British Naval pilot was under the batsman's orders but on U.S. Navy carriers he was merely told what he was doing. The signals were, therefore, reversed.

Approach Technique

An approach was made at about 15 per cent above stalling speed. When flattening out and making contact with the deck the familiar float and/or bounce seen on airfields had to be avoided at all costs because they might well result in the aircraft floating or bouncing over all the wires and finishing up in the safety barrier. It was also essential for the same reason that the arrester hook should not bounce on striking the deck.

Good control characteristics at the stall were important in giving the pilot confidence that he could safely keep to a minimum his margin of speed.

Good rebound damping, needed to avoid bounce, was defined as the ratio of energy returned to aircraft to the total vertical kinetic energy. This ratio should be less than about 0.25.

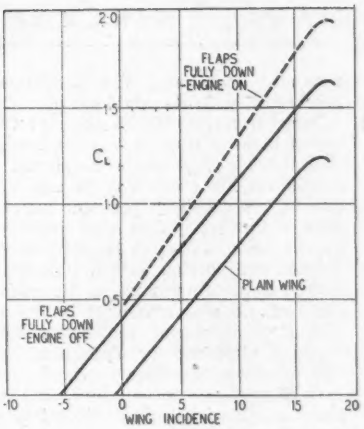
Excess lift was counteracted on airscrew-driven machines by a loss of slipstream lift when cutting the engine. It could also be counteracted by a tricycle undercarriage which reduced incidence on touchdown. Hook bounce was prevented by a suitable spring and damper which held the hook arm down. The hook must be so disposed that when arresting the aircraft it did not cause excessive pitching, otherwise the airscrew—or the pilot—might be damaged. A hook mounted at the tail end was found in the case of the Seafire to be more satisfactory than one which was mounted farther forward.

Absorbing the Energy

It was necessary to absorb the kinetic energy of the aircraft, which was travelling down an inclined path and this velocity could be resolved into two velocities, one vertical and one horizontal. The vertical velocity was absorbed in the undercarriage and was expressed in f.p.s. (ft/sec). The modern requirement was to cater for a vertical velocity of 16 f.p.s. For a landplane 10 or 15 per cent might be satisfactory.

The horizontal component was absorbed by the ship's arrester gear and as the ship was operated by sailors this had to be expressed in knots. The arrester gear could absorb about 60 knots relative to the ship, to which could be added about 20 knots relative wind over the ship, giving a total of 80 knots.

The importance of the relative wind was seen when it was realized that without it the arrester gear would have to absorb nearly twice the energy. Only about 2 per cent of the total kinetic energy was absorbed by the undercarriage. Maximum decelerations catered for were about 3G, both vertically and horizontally.



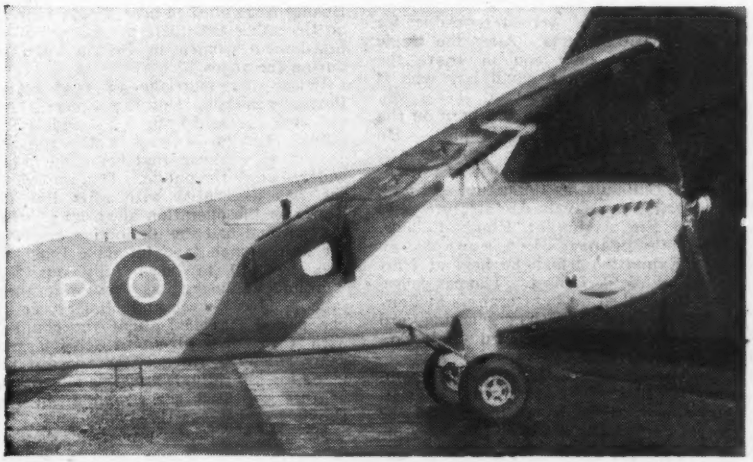
Variation of lift coefficient with incidence showing effect of flaps and slipstream.

Turning to the other items in the list of added handicaps, Mr. Clifton said that on naval fighters the general-purpose radio set was heavier by about 10lb than the R.A.F. equivalent, while an additional set was carried for ship homing. Reconnaissance types might have to carry special radar apparatus for detecting ships, involving not only weight but often external blisters.

Concerning folding wings he said that it was obviously impossible to make a foldable joint without "loss" of weight, approximately 1½ per cent of all-up weight. While there was no fundamental difficulty from the engineering point of view in introducing a fold, it was necessary to see that the stiffness of the wing, particularly in torsion, was not impaired, otherwise aileron control might suffer. It was extremely important to reduce to a minimum the time taken after landing-on for the aircraft to taxi forward on to the lift and descend to the hangar, because this time governed the rate at which a squadron could be received on board, and hence the length of time a carrier might have to be "out of station." The time allowance for landing-on might be only 30 seconds per aircraft. Power folding was favoured so that the folding could be done while taxying forward. This added further to the weight and complication.

Restriction on Size

Not only was the width for lift and stowage limited but length and height were also restricted. The effect of this upon the heavier types had been to encourage high-lift devices in order that wing area might be kept down to a minimum. Thus we had the Youngman flap on the Fairey Barracuda, a device which effectively increased wing area for landing, and was also usable as a dive-brake. Mr. Clif-



The variable-incidence wing of the Supermarine S. 24/37 ("Dumbo"). This development is now being applied to an amphibian.

NAVAL AIRCRAFT

ton also mentioned the Blackburn Firebrand, with its double flap.

Another interesting example of the use of high-lift devices was the Supermarine S. 24/37 which developed a maximum lift coefficient of 2.6, engine-off, or about 50 per cent greater than a Spitfire. This was achieved by the use of full-span Handley Page slots in conjunction with a part-span slotted flap. Engine on, a lift coefficient of 3.9 was measured in flight. The slats increased the permissible angle of incidence for maximum lift. The wing was therefore provided with variable-incidence gear which enabled the fuselage to stay at a normal incidence when the increased wing incidence and high lift were being used for landing.

A successor to the Sea Otter was being built embodying the variable-incidence principle. The design max. lift coefficient, engine-off, was 3.5.

Finally, a torpedo was an awkward thing to stow on a moderate-sized aircraft and it was a nice point to decide whether to leave it outside so as to have the best performance when it had been dropped, or put it inside to have a cleaner machine when it was stowed. Mr. Clifton did not think that the torpedo would be superseded for a long time and we must put up with the trouble of stowing it. A possible rival to the torpedo was the rocket-propelled bomb.

The Future

Concluding his lecture, Mr. Clifton indulged in a little speculation as to the future of naval aircraft. Two developments, he thought, were likely to have a profound effect, namely, the atom bomb, and the jet-propelled rocket or missile directed by radio. The atom bomb conferred a special advantage on the Navy, for warships and carriers were really mobile fortresses and airfields, and their mobility made them more difficult to knock out. Radio-directed missiles might eventually displace the piloted naval aircraft for defensive or offensive purposes. In these circumstances the carrier would become a battleship with a store of expendable missiles, and a complicated radio "brain" for directing them and for detecting the approach of hostile objects.

The obvious advantages of mobility might lead us in the direction of giant flying boats, capable of long-range taxying, and of taking to the air when attacking or in danger of being attacked. Refuelling and re-arming from remote bases specially chosen and built to resist atom bomb attack, a fleet of such craft might converge and deal a devastating reply in a short space of time to a threat from any quarter. These flying boats might increase their operational range and endurance by travelling as surface ships. The fundamental reason for this was that the best L/D we could hope for from an aircraft was about 15, whereas at low speed we could attain 100 from a ship. The power, and hence fuel load, to travel from A to B was inversely proportional to L/D.

The day might come when the Royal Navy would consist primarily of aircraft with possibly some attendant submarines for servicing and refuelling purposes. Would the men who manned these aircraft be known as sailors?

T. R. THOMAS

An Appreciation by Sir Frederick Handley Page

EVERYONE connected with civil aviation will learn with the greatest regret of the sudden death of T. R. Thomas, the Secretary of the Air Registration Board.

I first met Thomas when he was Joint Secretary of the Joint Advisory Committee of Lloyd's Register and the British Corporation Register, a committee which dealt with the inspection of private owners' aircraft and the renewal of their certificate of airworthiness. Later, in 1936, when the recommendations of the Gorell Committee were adopted, Thomas was the secretary of the small committee of operators, manufacturers and insurers, of which I was Chairman, who, with official representatives, drafted the constitution of what is now the Air Registration Board.

The Air Registration Board came into being in 1937 and Thomas was appointed its first Secretary, a post which he filled until his untimely death last week.

Thomas has left us at the comparatively young age of 53, loved and mourned by all who knew him. His closest friends and associates, and he himself, knew this was likely to happen suddenly, but we all preferred to ignore the inevitable. His greatness was housed in the frailest of bodies, and during the past twenty years he spent much of his time literally fighting for breath. I have seen him on many occasions enter a meeting and for some minutes be incapable of speech because he had climbed half a dozen steps. In spite of this great physical handicap, I have never known him shirk any duty—and he has encountered many tough propositions in the creation and operation of the Air Registration Board.

I know of no one who could draft a clearer memorandum setting out fundamental principles and expanding policy decisions into executive detail. The Board and British civil aviation owe a great debt of gratitude to Sir Maurice Denny, the first Chairman, and T. R. Thomas, the first Secretary, for the sound way in which the organization has been built up and the long hours which they have spent in its initial administration, to say nothing of the difficulties which were met at the onset of the war when the Air Registration Board was only just beginning to feel its feet. One never thought of the Board without seeing T. R. Thomas and his characteristic signature, and except for his love for fly-fishing, and a stolen hour in his little workshop, he gave his whole to the Board. Many have cause to bless T. R. Thomas for his help and kindness, and he and his wife were responsible for many charitable acts. After the tragic loss of their only son in 1941, the Thomases adopted a small boy who is now 11 years of age.

Tom Roberts Thomas was born on the 1st of March, 1893 in Glasgow. He entered the shipbuilding industry and served his apprenticeship with the Sunderland Shipbuilding Company, and took a degree in Naval Architecture and Marine Engineering at King's College, Newcastle, in 1912. He was awarded an 1851 Exhibition which he held at Harland and Wolff, Belfast. Thomas subsequently worked on light cruisers at Fairfield, Govan, and in the submarine yard of Messrs. Cammell Laird and Co., Birkenhead.

In 1916 he joined the British Corporation Register of Shipping and Aircraft, and almost at the same time joined the Royal Engineers. He served in Palestine and was responsible for building and maintaining transport on the Nile. As a result of his service he spent much time in hospifal and was invalided out of the Army in 1919 and returned to the British Corporation the following year. He was sent to London in 1927 by the British Corporation to organize their aircraft committee, and in 1932, was appointed Joint Secretary of the Joint Aviation Advisory Committee of Lloyd's Register and the British Corporation Register.

Thomas's death is a great loss to British civil aviation, but to-day our thoughts are those of the deepest sympathy with his widow in her great bereavement.

DEATH OF DOROTHY SPICER

WITH the death of Mrs. Richard Pearse, who was killed, with her husband, when the F.A.M.A. York airliner in which they were travelling to Buenos Aires crashed near Rio de Janeiro on December 3rd, there passes one of the best-known women in British aviation during the 1930s.

Before her marriage in 1938, Mrs. Pearse was Miss Dorothy Spicer, and although she held both "A" and "B" pilots' licences, it was in the rôle of an aircraft engineer that her name came widely before the public. This was when she was associated with Miss Pauline Gower in the operation of an air charter concern and had the distinction of being the first woman (and for some time the only woman) to be a fully qualified "ground engineer," as they were then called. Miss Gower and Miss Spicer at one period travelled about the country with their own air-circus (the former using chiefly a three-seater Spartan biplane for joy-riding), and this all-woman venture captured the headlines in the Provinces wherever they went.

Mr. Richard Pearse was on his way to take up the post of South American representative of British Aviation Services, Ltd., having previously been with the Ministry of Civil Aviation.

British enterprise and achievement in 1946 are exemplified by the Rolls-Royce Nene, the Miles Marathon, the D.H. 108 and the raising of the world's speed record by G/C Donaldson.

Record Flights and Great Expectations : Technical Preparation for Tomorrow : Air Transport is Nationalized

IN the records of aeronautical science, the year 1946 will be adjudged a memorable one, abundantly fruitful, yet full of promise. It was not a period of monumental developments, though some important aircraft made their first flights, but one of consolidation, development and especially research.

The true significance of a year's progress lies not so much in the yield of new aircraft but in the discoveries and decisions made, vital studies undertaken and lessons learnt. Thus, in 1946, though new and spectacular Service machines were much in evidence (this being the year of the historic Farnborough and Radlett displays) and though the ruffled tide of civil development was inexorably on the turn, it was the development and flight-testing of unorthodox research aircraft which distinguished it. Not until 1946 did the aeronautical community become truly conscious of the ultimate benefits promised by tailless aircraft, swept-back surfaces, rocket propulsion, compounded power plants and—less spectacular, but of greater immediate importance—gas turbines in civil aircraft.

HIGH LIGHTS OF 1946

FULL as 1946 has been of outstanding events and meritorious achievements in the world of aviation, there can be little argument as to what constituted THE aeronautical high-light of the past year. It was the setting of the World's Air Speed Record at a fraction over 616 m.p.h. by Grp. Capt. E. M. Donaldson in the Gloster Meteor IV, E 549, on September 7th.

It is a matter for some national satisfaction that this most prized of all flying records should be held by Britain, but in fairness it must at once be added that the long-distance record set up by the U.S. Navy's Lockheed Neptune, *Truculent Turtle*, was, from the technical point of view, an almost equally notable achievement. As will be remembered, this P2V took off from Perth, Australia, on September 29th, and flew non-stop to Columbus, Ohio, where it landed at just after noon on October 1st, having covered a distance of 11,236 miles in 55 hr 18 min.

But it is in the nature of man to be more impressed by a flash of breathless speed (This-is-Littlehampton-that-was!) than by a sustained and therefore less spectacular effort, and it has also to be remembered that the present approach to the speed of sound has a special significance, both technical and dramatic.

There have, of course, been a number of other record flights, and a number of "firsts" of one kind and another of varying importance. In March, for example, a Lancastrian of R.A.F. Transport Command flew from Northolt to Wellington, New Zealand, and back in the record time of 6½ days, covering the outward journey in 62 hr 5 min and the return trip in 61 hr 28 min. But even this clipped time for the outward flight to New Zealand was improved upon in August by the Empire Air Navigation School's streamlined Lancaster *Aries*, which got there in 59 hr 51 min, and collected a brace of intermediate records on the way. From Blackbushe it reached Karachi in 19 hr 14 min, and Darwin in 45 hr 3 min. The same aircraft, incidentally, had lowered the England-South Africa record in January, when it flew from Portsmouth to Cape Town in 32 hr 21 min, captained by Wing Cdr. C. M. Dunnicliffe. The distance was 6,900 miles and the time beat the previous fastest—Alex Henshaw's Cape record set up in 1939 in a Mew Gull—by no less than 7 hr 4 min.

With and Without Engines

Before leaving the subject of records set up during the past year one more of a different kind should be recognized, namely, the British altitude and sailplane records annexed by Lt. Cdr. (A) J. S. Sproule and Lt. (A) Sothers during the first week-end in July. In a German Kranich sailplane they flew from the Naval Air Station at Hinstock (Shropshire) to Princes Risborough, a distance of 102 miles in a straight line, and during the flight reached a height of 5,600ft. Finally there was one other outstanding event which, though not exactly a record in the narrow sense, was still a "fastest ever," and that was the Lympne High-Speed Handicap Race at the Folkestone meeting organized by the Cinque Ports Flying Club on August 31st- September 1st. This race was won by Bill Humble in a Fury I at 342 m.p.h., but the fastest competitor was Geoffrey de Havilland who came home second at a speed of well over 400 m.p.h. This was the world's fastest air-race and the first post-war air race meeting in Britain.

All kinds of other "firsts" and "firsts since the war" might qualify for inclusion, but space limits us to the selection of but one or two of the more important. On January 1st, for instance, Air Vice-Marshal D. C. T. Bennett left Heathrow in a Lancastrian on the first proving flight for British South American Airways' service to Buenos

THE OLD YEAR

Aires, covering the 6,214 miles in the record time of 29 hr 5 min. On the same day the flying school at Cambridge went into action as the first such organization to resume post-war private instruction, and Cambrian Air Services were the first post-war charter concern to be "officially" opened for business. Also in January, Jim Mollison made the first post-war delivery flight to South America with a Percival Proctor.

In February, "Panair" made the first post-war scheduled transatlantic flight with a Constellation carrying 29 passengers and about a ton of freight. In April B.O.A.C. began its "York" service between Hurn and Cairo, and in May reopened the flying-boat service to Singapore, from where Qantas took it to Sydney.

In June there was the first post-war Farnborough Display, and the first full-scale air pageant at Eastleigh, staged by the Southampton branch of the Air League. On July 1st, B.O.A.C. restarted the transatlantic service between Heathrow and La Guardia with the Constellation, *Bristol II*, and in August Mr. Leslie L. Irvin (of parachute fame) made the first post-war private-owner crossing of the Atlantic in a Beechcraft piloted by ex-Imperial Airways captain, A. B. H. Youell.

During September 12th—15th there was the first post-war S.B.A.C. Show and R.Ae.S. Garden Party at Radlett, and on the 9th the Lincoln, *Excalibur*, left Blackbushe on the Central Bomber Establishment's first overseas liaison mission, a five week tour of the Far East, Australia and New Zealand.

At the end of September America held her first post-war National Air Races at Cleveland and mildly surprised the world by doing so without any fatalities, and in November there was the first post-war Paris Aero Show during which the Nene Lancastrian gained the distinction of being the world's first jet-powered airliner to carry passengers from one country to another.

A number of other landmarks (or should one say airmarks?) in Aviation History must also be given due recognition. For example, on January 12th the R.Ae.S. celebrated its 80th birthday with a Guildhall dinner. Then there was the handing-over of Heathrow by the Air Ministry to the Ministry of Civil Aviation as a New Year Gift, and the subsequent christening of this tented terminal, "London Airport," by Lord Winster. But to the personnel of the R.A.F., the "New Year Gift" which no doubt surpassed all others was the introduction of the new increased rates of pay. A "gift" of the opposite kind came for the amateur pilot the following month when the Government announced its intention not to resume the subsidy of flying clubs. Also in the same month A. V/M. Bennett caused a brief stir by "disappearing" for a few anxious hours when he flew to Wolverhampton in a light aircraft and, because those who should have known where he had gone didn't, was officially reported as missing.

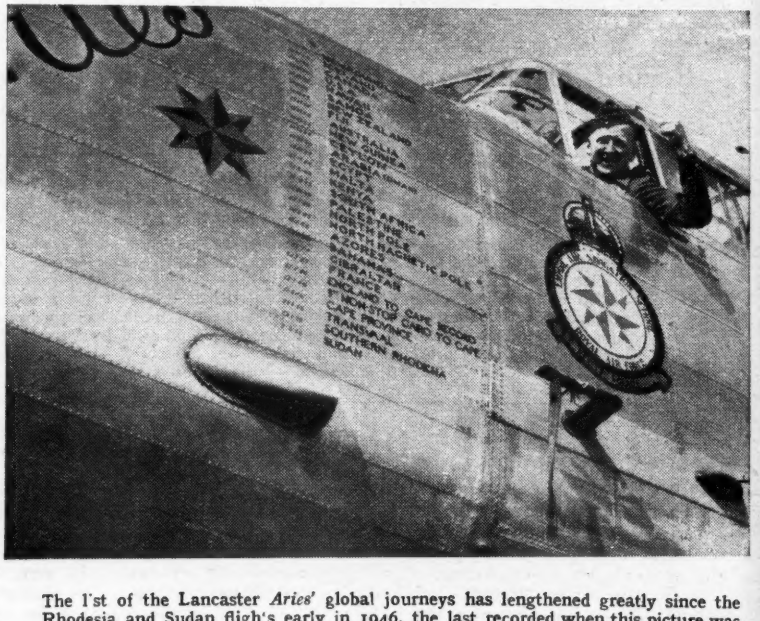
Victory Parades

June saw the great Victory Day fly-past over London in characteristic British summer weather, and in July, No. 35 Squadron took their ex-operational Lancasters to America for the highly popular goodwill tour which reached its climax in participation in the U.S.A.A.F.'s great fly-past at Los Angeles on "Air Force Day," August 1st.

There were some historic "lasts" during the year too, such as the handing-over by the U.S.A.A.F. of the last of its 112 British airfields (Honington) on February 26th, and the last flight of the Transport Command Mosquito Air Mail Service to European capitals in July after a year's service. Unfortunately the year was also marked by the loss of one of aviation's greatest pioneers in the death of Dr. F. W. Lanchester on March 8th at the age of 77, the loss of one of its most industrious and popular supporters in the death of Sir James Bird in August, and the loss of one of its best known test pilots in the death of Geoffrey de Havilland in September.

Some U.S. Feats

Let it not be thought, by the way, that we regard the year's high-lights in American aviation as being limited to the one or two events so far mentioned. The *Truculent Turtle's* feat, for instance, shared the headlines about



The 1'st of the Lancaster *Aries'* global journeys has lengthened greatly since the Rhodesia and Sudan fligh's early in 1946, the last recorded when this picture was taken.

equally with that of the B-29, *Pacusan Dreamboat*, which early in October flew non-stop from Honolulu to Cairo via the North Pole, covering the 9,500 miles non-stop in 39 hr 36 min. Indeed it had been intended to pay due tribute to the gallant American crew by giving them a fighter escort over British soil, but apparently the arrangements to notify Fighter Command of her approach went awry.

America had previously set up a long-distance record when, in February, a B-29 flew non-stop from Guam to Washington D.C. (8,198 miles), while one might also mention such historic moments as the first non-stop flight from Honolulu to the Philippines (5,525 miles) by a B-29 in May, and the maiden flight of the gargantuan B-36 which first raised her 125 tons aloft early in August.

But to end on a lighter note, one might recall that when in February a Shooting Star flew from coast to coast in America at 584 m.p.h. it was later disclosed by a Californian correspondent to *Flight* that the U.S. authorities had omitted to mention the little matter of freak tail-winds up to 160 m.p.h.; or that in July, Philip Stanbury casually took a Meteor up to 46,500 ft and thought nothing of it; or even that April 1st was the date chosen on which to merge the M.A.P. into the M. of S.!

Yes, one way and another, 1946 was quite a notable year.

THE RETURN OF CIVIL FLYING

IF the operators, clubs and private owners had been ready, and if machines had been available, the first day of 1946 might have produced a skyful of aircraft. For it was on this day that, for the first time for six years, the air was again given its freedom over the British Isles. But with the freedom came also restrictions in the form of a spate of *Notices to Airmen*, telling the apparently uncontrolled pilot exactly what he might not do. However, one or two clubs, and at least one charter company, were ready to get moving at the firing of the starter's pistol, though the former were working without a subsidy and the latter without suitable aircraft.

On this same New Year's Day Heathrow airfield—later to be designated London Airport—was officially opened by the Minister of Civil Aviation. Since but one runway was available, and buildings were largely non-existent, the ceremony was somewhat premature, and for all the normal services Hurn, near Bournemouth, continued to be the terminal. However, the ceremony drew attention to the fact that London had an airfield which would eventually be one of the largest in the world.

Early in October, Baron Nathan of Churt was appointed Minister of Civil Aviation.

As a preliminary to the introduction of the Civil Aviation Act, the first month of the year saw the publication of a White Paper explaining the general principles of the proposed nationalization of air transport. In this nationalization there were to be three "chosen instruments" to deal with all scheduled airline operations, while selected airfields were also to be taken over as State-operated concerns. Later in the month the constitution of these three "instruments" was explained—British European Airways Corporation was to deal with European and internal services; British South American Airways Corporation was to run the services which its name suggested; and the original British Overseas Airways Corporation, with a reconstituted board, was to deal with Atlantic and Empire services. Until the passing of the Civil Aviation Act the new Corporation, B.E.A., operated as a Division of B.O.A.C., and were given the use of the R.A.F. Station at Northolt as a terminal.

Empire Services

Shortly afterwards, B.O.A.C. outlined its plans for the future with six major services—to India, Australia, South Africa, West Africa, China and the North American Continent—while the European Division also outlined its prospects for the immediate and more distant future. Considerable changes were also being planned by the Ministry of Civil Aviation in the matter of flying licences, with the pilots' categories increased from two to four in number; these changes have not yet been put into effect.

Sir Henry Self, who filled the new post of Permanent Secretary to the Ministry of Civil Aviation.

While the appropriately but complicatedly named Provisional International Civil Aviation Organization was continuing its deliberations, in the eventual hope of world standardization of airline and airfield requirements, a bilateral agreement was reached at Bermuda between the British and United States Governments concerning the mutual operation of services. This agreement provided the greatest contribution to the future progress of Anglo-American civil aviation relations, and was all the more promising since both sides gave way in order that comfortable agreement should be possible. Meanwhile, agreement had been reached, too, over the operation of the trans-Pacific services, and British Commonwealth Pacific Airlines was provisionally formed as a combination of British, Australian and New Zealand interests.

While the chairman of B.O.A.C. and the Minister of Civil Aviation had both, at different times, impressed the public with the idea that, in future, flying was to be offered to the many, rather than the few, the fact was announced during February that no subsidy would be available for the clubs. A hundred ex-Service aircraft were, however, offered—many in a somewhat poor state of repair—and a surprisingly large number of pre-war clubs elected to re-start or to continue operations on an unassisted basis. The flying rates, though high, were progressively reduced during the year, but it would seem that without direct or indirect assistance the picture for the future is not very clear. At the same time the Association of British Aero Clubs was reformed and renamed.

Mr. G. S. Lindgren, who succeeded Mr. Ivor Thomas as Parliamentary Secretary to the Ministry of Civil Aviation.

Atlantic Conference

March saw the first of a series of bilateral agreements between the British and various foreign Governments—in this case with the French. The P.I.C.A.O. also started and completed a series of conferences in Dublin, covering the problems of Atlantic airline operation. On the debit side of the account, however, B.O.A.C. announced the discontinuation of their own Atlantic service, since the Boeing boats used could no longer be kept serviceable. This discontinuation was to hold good until the five Constellations, ordered during January, could come into service.

The text of the Civil Aviation Bill was published in April. In short, this Bill ordained that "it shall not be lawful for any person other than the three Corporations, their associates and servants . . . to carry passengers or goods . . . upon any scheduled journey . . ." The remaining freedom was, however, being very vigorously exploited by a rapidly increasing number of charter operators. A month or so later the majority of these companies combined to form an Association which has since been very useful in the work of generally looking after the charter operator's interests. In the course of long-range planning the Ministry of Civil Aviation announced future extensions and developments for Heathrow, and, on the personnel side, the institution of the post of Permanent Secretary of the Ministry of Civil Aviation in place of the previous Director-Generalship.

During June, B.O.A.C., who had then obtained delivery of their Constellations, started a series of Atlantic proving flights with these aircraft. Unfortunately, at the beginning of the following month, after an accident in the United States, these were temporarily grounded pending modifications. In July, the Civil Aviation Bill was passed by the Commons, and after a little trouble over one or two points, including a suggested fourth Corporation for Scotland, was duly passed by both Houses.

During September P.I.C.A.O. delegates visited this country to make a detailed study of the various radio and radar developments, with the eventual idea of reaching a decision on standard radio navigational methods to be used on the world's airlines. P.I.C.A.O. also reached a decision in the matter of ocean weather stations and their approxi-

THE OLD YEAR

mate positioning. During September B.O.A.C. ordered six Boeing Stratocruisers for delivery in due course.

Two events of interest to the amateur pilot occurred during October. After pressure from a number of quarters the Ministry of Civil Aviation reduced the standard landing charges for small aircraft at their own airfields, and the Duke of Sutherland offered a prize to the British Gliding Association for a suitable sailplane design.

The organization which had been at work on the co-ordination of airline and aircraft standards since 1919—I.C.A.N.—was finally liquidated during November, its place being taken now by P.I.C.A.O. Following the appointment of a new Minister of Civil Aviation, two new organizations were set up—a Board to advise and recommend in matters of airline safety, and a Committee to study the whole question of private flying. At the same time, a Scottish Advisory Council was formed to advise B.E.A. on the operation of services to and in Scotland. The announcement was made that Ground-Controlled Approach radar would be installed at Heathrow, and that F.I.D.O. would be put into experimental use at Blackbushe, an R.A.F. Station temporarily taken over by the Ministry as a diversionary airfield. At the turn of the year the Ministry was, with the Services and the operators, endeavouring to devise a new and more clearly-defined air traffic control plan.

AIRCRAFT OF THE YEAR

OUTSTANDING among the year's crop of military types was the Supermarine E. 10/44 fighter, powered with a Rolls-Royce Nene turbine jet of 5,000 lb static thrust. Flown in dashing style at the S.B.A.C. Show by Mr. Jeffrey Quill, this machine demonstrated in a particularly forceful manner the improvement in performance offered by the turbine jet. The wing and undercarriage were those of the piston-engined Spiteful, but adoption of the new power plant gave an increase in speed of well over 100 m.p.h. and a corresponding gain in rate of climb. The "E. 10" was further notable for the precision of its construction, but the lack of a tricycle undercarriage was a legacy—not altogether a desirable one—from the Spiteful.

Later in the year the Nene was also installed in two de Havilland Vampire prototypes, giving an amazing increase in rate of climb without detracting from range at 30,000ft—a representative operational height. The primary development concerning the Gloster Meteor IV, which raised the world's speed record to 616 m.p.h., was a reduction in wing span from 43ft to 37ft 2in, thus lowering the aspect ratio from 4.95 to only 3.9. This apparently drastic curtailment affected performance only slightly (the top speed was 5 m.p.h. lower), but rate of roll decidedly benefited, as proved at Radlett by Mr. Philip Stanbury. It became known during the year that the Meteor IV will carry two 1,000-lb bombs as an alternative load to rocket projectiles.

Although as this is written, the prototype has not flown, the unique Saunders-Roe SR/A1 was being prepared for trials at the end of the year and some preliminary particulars became available. Measuring 46ft in span, the SR/A1 has two Metropolitan-Vickers F2/4 jet units mounted side-by-side in the hull, the intake being in the bows of the hull. The cabin is pressurized and the armament, as on previous R.A.F. fighters, is four 20 mm guns. It is proposed that the Saro automatic mooring scheme evolved by Mr. Arthur Gouge shall be used for this remarkable marine fighter.

No jet fighters of Hawker design were announced, but this great company brought the airscrew-driven fighter to a new pitch of performance in the Sabre-engined Fury I credited with a speed of 483 m.p.h. at 18,500ft—something like 150 m.p.h. faster than the Battle of Britain Hurricane. Except for engine and equipment the Fury I was similar to the Sea Fury X (Centaurus) which towards the end of the year was beginning to come off the production line for Naval Aviation (a new title conferred during the year on the Naval Air Arm).

Despite the magnificent performance of the Fury, Spiteful and Seafang, the speed "record" for airscrew-driven fighters still rests in the U.S.A., where a specially prepared P-47J Thunderbolt exceeded 500 m.p.h. in level flight. Speeds higher than 600 m.p.h. have been recorded in dives, and a Spitfire retains the British "record" with 620 m.p.h.

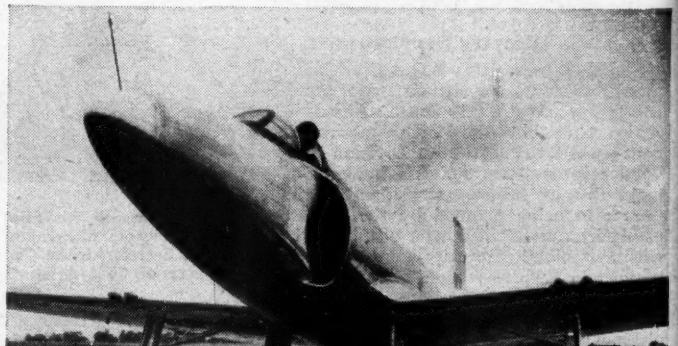
The Spitfire-Seafire and Spiteful-Seafang series of fighters continued to distinguish themselves during the year and it is greatly to the credit of the Supermarine company that the Seafire 47, a Griffon-powered Naval fighter with an ancestry readily traceable back to the original Spitfire, should have been developed for a speed of over 450 m.p.h. and for a greatly extended range. De Havilland Hornets established themselves in R.A.F. squadrons and remained unchallenged as the fastest standard piston-engined fighters in the world.

It was something of a disappointment that, although the U.S.A. announced several prototypes of jet-propelled bombers, no British aircraft in this class was forthcoming during 1946. The Avro Lincoln continued to succeed and supplement in R.A.F. bomber units those incomparable warhorses the Lancaster and Halifax, but no new bomber was designated as a Mosquito replacement. The Mosquito 34, 35 and 36 stood unchallenged as twin-engined photographic reconnaissance, bomber and night-fighter aircraft. Naval units received Sea Mosquito 33s.

Military Transports

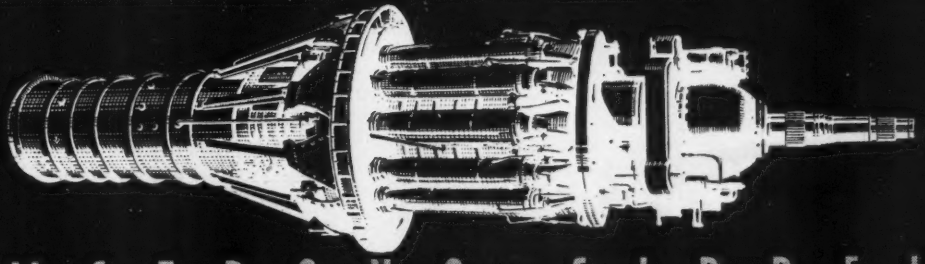
For Transport Command Handley-Page Hastings and Airspeed Ayrshire high-speed military transports were ordered. The Hastings is the Service counterpart of the Hermes, but because of the particular requirements in Transport Command, which generally handles more concentrated loads than civil airlines, will not necessarily be developed along the same lines as the Hastings, i.e., with lengthened fuselage and tricycle undercarriage. Coastal Command took delivery of Short Seafords.

The Fairey Spearfish torpedo dive-bomber machine and the Short Sturgeon were both in limited production for Naval Aviation, the Sturgeon as a high-speed target tower.



Mr. Jeffrey Quill offers a greeting from the cockpit of the Supermarine E.10/44 jet fighter.

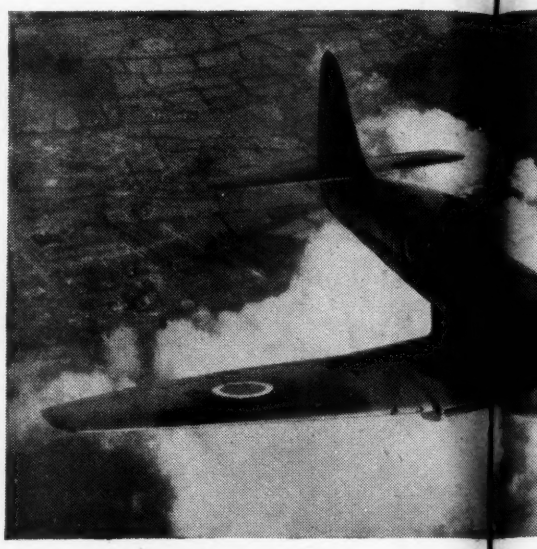
POWER FOR THE PLANES OF TO-MORROW



ARMSTRONG SIDDELEY

PYTHON GAS TURBINES

Developed specifically for operation from aircraft carriers, the Short Sturgeon has twin Rolls-Royce Merlins driving Rotol contra-rotating airscrews.



The latest Hawker piston-engined fighter, the Fury Napier. The Sea Fury X, with Bristol Centaurus, was

THE OLD YEAR

It was at Farnborough in June that the prototype Sturgeon, with its twin Merlins and contra-rotating Rotol airscrews, made its début. Prototypes of the Supermarine S.14/44 amphibian flying boat with variable-incidence wing and of the Heston twin-boom Air Observation Post aircraft were under construction as the year closed.

There were some particularly interesting and significant developments among military training aircraft. Large orders were placed not only by the R.A.F. but by foreign Governments for the Percival Prentice which introduces a new training technique whereby a third man is able to note the instructor's movements and comments. The Boulton Paul P. 108 was not announced as having flown during the year, but released particulars showed it to be a machine of exceptional promise. It is the first of the new trainers to have a gas turbine power plant (Armstrong-Siddeley Mamba or Rolls-Royce Dart). Both the Spitfire and Firefly I were developed as dual-control trainers.

Civil Transports

Particularly is it true of British civil aircraft that the year was notable for consolidation and development; not until 1947 and 1948 will most of our new transports, e.g., Bristol 167, Ambassador, Nene-Tudor, Mamba-Marathon, Concordia, AW55 and Viceroy, be ready to fly.

It was not however, left entirely to the Yorks and Lancastrians, the Sunderland, Halifax, Anson and Oxford conversions, the DC-3s, and the rest, to bear the entire load on our transport system. Useful quantities of Vickers Vikings and Bristol Wayfarers and Freighters began to take their place alongside these hard-pressed stalwarts. Meanwhile the Avro Tudors I and II were flying their trials before reinforcing the transport fleets in 1947. The first of the Short Solents was launched and flown in December.

The New Year should see increasing use of gas turbines, the final emergence from its experimental state of the pressurized cabin and the more general introduction of tricycle undercarriages, as frequently advocated in *Flight*. Throughout the Old Year designers have worked for safety, particularly in symmetric flight at take-off, and, on the insistence of the Air Registration Board, they will progressively apply new aids towards reducing danger.

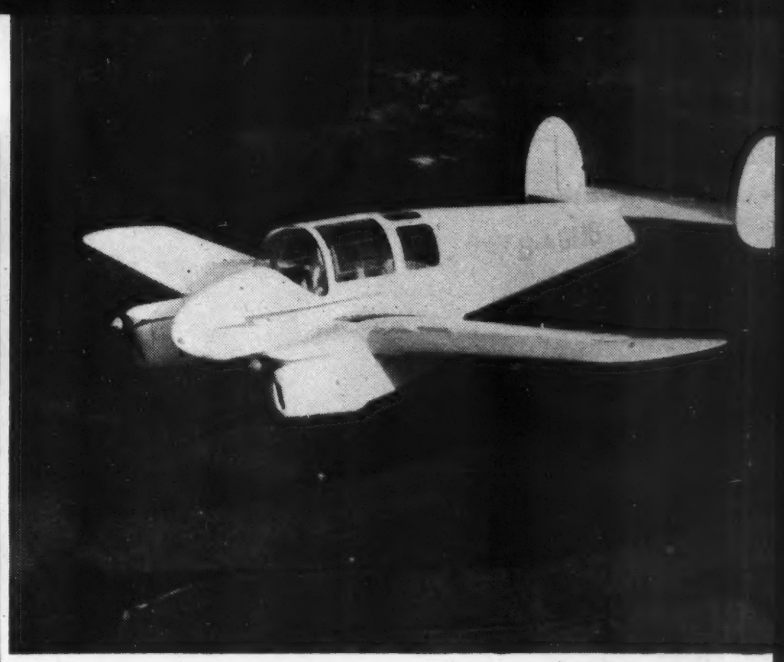
With specific reference to new and improved types of aircraft which flew during 1947, the long-fuselage Mk I B Vickers Viking completed its trials and passed into service. This 24-27 passenger machine, with the new civil-rated Bristol Hercules 634 engines, weighs 34,000 lb, and cruises at 210 m.p.h. at only 50 per cent power. A project was announced for substituting twin Rolls-Royce Nene turbine-jets for the Hercules, to attain cruising speeds up to 393 m.p.h. at 10,000ft Vickers-Armstrongs further released preliminary particulars of the VC2, or Viceroy, with four Rolls-Royce Dart airscrew-turbine units. Designed to Brabazon II requirements, this is a parallel development with the AW 55.

The second prototype of the Handley-Page Hermes I/Hastings I flew in an exemplary manner during May and, paced against a Spitfire, attained a maximum speed of 355 m.p.h. As the year progressed Handley-Page revealed more and more details concerning their Hermes development programme. This is now known to include

Introducing a new training formula to the R.A.F. the Gyroned Pe seater.

The convenience, enjoyment and the safety of passengers were primary concerns of the Chrislea Ace's designer.

r, the Fur Napier Sabre engine, is capable of over 480 m.p.h.
tol Centa e, was in production during the year.



One of the most attractive light aircraft yet produced, the Miles Gemini seems assured of success.

the Hermes IV (a long-fuselage version with Hercules 263s, pressure cabin and tricycle undercarriage), and the Hermes V, a similar aircraft with Bristol Theseus airscrew-turbines. The firm was rewarded during November, with an order from the Ministry of Supply for twenty-five Hermes IV's and two prototypes of the Mk. V.

By the end of 1945 the Avro Tudor I was already becoming familiar to *Flight* readers, but the Mark II version was a 1946 product and differed from the Mark I in having a greatly lengthened fuselage (105ft 7in against 85ft 6in) seating up to sixty passengers. Cruising speed showed a drop of only 10 m.p.h. at 15,000ft, demonstrating that wetted area is relatively unimportant on a large machine provided that careful attention is paid to aerodynamic design. All-up weight—at 80,000 lb—remained the same.

Particularly attractive in operational characteristics as in appearance, the four-Gipsy Miles Marathon was flying its prototype trials and its makers announced the development of a twin-Mamba version which seems assured of a rosy future.

The delightful little three-passenger Gemini, with twin Cirrus Minors, was Miles' 1947 offering to the private-owner and charter operator. Unique among small aircraft the Gemini cruises at 135 m.p.h.

Finally, two other "1946" types, at opposite ends of the scale, merit notice. The Short Solent, twelve of which have been ordered for B.O.A.C.'s far Eastern route, weighs 75,000 lb and has a span of 112.8ft. This magnificent boat, powered by four Hercules 637's will cruise at 210 m.p.h. over a non-stop range of 2,500 miles. Passenger comfort is of an exceptionally high order.

The little Chrislea Ace is a high-wing three-seater with a tricycle undercarriage, all-round vision and single-wheel control.

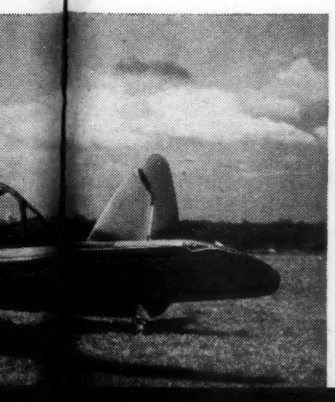
Research Aircraft

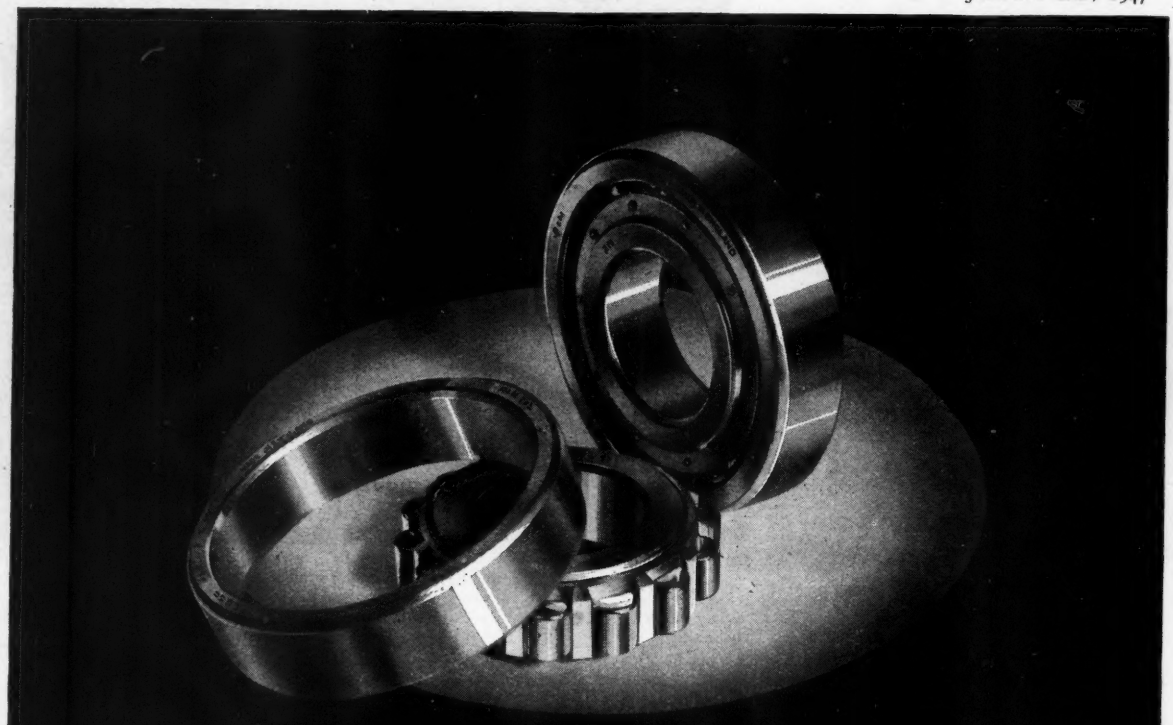
On May 15th, test flying was initiated on the DH 108 high-speed research aircraft. While having a Vampire fuselage, this type reflected German influence in the design of its sharply swept-back wing which obviated the necessity for a tailplane. The 108 was, in fact, designed and built solely for the purpose of studying control and stability problems in aircraft with swept-back wings. Mr. Geoffrey de Havilland conducted the initial tests quietly and systematically but, by the time of the S.B.A.C. Display at Radlett, it was evident that he had the greatest confidence in the flying qualities of the aircraft. On September 27th he took off in the second prototype from Hatfield, having announced that he intended to dive the machine at a high Mach Number and to fly at high power near the sea to check the speed and behaviour in record-attempt conditions. About fifteen or twenty minutes later, the aircraft was seen to break up and fall into the Thames, north-east of Gravesend. The manufacturers have since stated that they intend to continue with full effort the research work on which they were engaged with the 108.

Flying continued on the Handley Page Manx tailless aircraft with two Gipsy engines and a very great deal of

Precursor of the Hermes civil transport, this magnificent Handley Page Hastings military transport did its initial trials during 1946.

A.F. the ined Percival Prentice three-
ter.





We shall be pleased to solve

ALL BEARING PROBLEMS

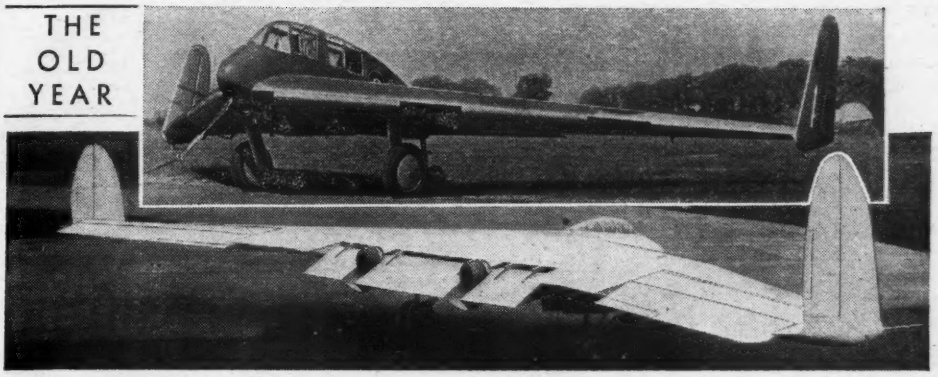
Many products can be made smaller and more compact, their operating efficiency increased and maintenance reduced by the use of R&M Ball or Roller Bearings.

ANTI-FRICTION – remember R&M

RANSOME & MARLES BEARING COMPANY LTD
NEWARK-ON-TRENT ENGLAND

K/RMS

THE OLD YEAR



Like the AW 52G research glider, the General Aircraft glider (top) has been used to provide data for the design of large tailless aircraft. Below is the twin-Nene AW 52, completed during December.

important information was derived from tests with the Armstrong-Whitworth AW52G tailless glider, frequently towed to a height of about 16,000ft by a Whitley and released, measurements being taken by automatic recorders during the glide. The AW52G was followed by the AW52 twin-jet experimental mailplane, introduced to the Press during December and described in *Flight* of December 19th. Measuring 90ft. in span, and powered by twin Rolls-Royce Nene turbine-jet units, the AW52 incorporates boundary layer control by suction, thermal de-icing, a pressurized crew compartment, and a steerable nose wheel. It promises to be one of the most important British aeronautical achievements of recent years.

General Aircraft, Ltd., have contributed further to the study of tailless aircraft design by building gliders to a Government order. One of these, first flown late in 1944, was described for the first time during 1946.

Another comparatively old machine of which particulars were released during the year, was the Supermarine 322 "Dumbo." This was originally designed as a deck-landing torpedo-bomber, but, with its variable-incidence wing, is a research aircraft of note.

At about the time of the S.B.A.C. Display, Miles Aircraft, Ltd., were permitted to publish many details concerning their M52 supersonic design, abandoned by the Ministry of Supply and the Air Ministry for reasons of economy. With its span of 27ft. and its special Power Jets unit the M52 was intended to attain an ultimate speed of about 1,000 m.p.h. The touchdown speed was to be 170 m.p.h., requiring a two-mile landing run.

The basic design of the M52 is reproduced in the Vickers pilotless transonic research model, a number of which are now being built for experimental launching from a Mosquito.

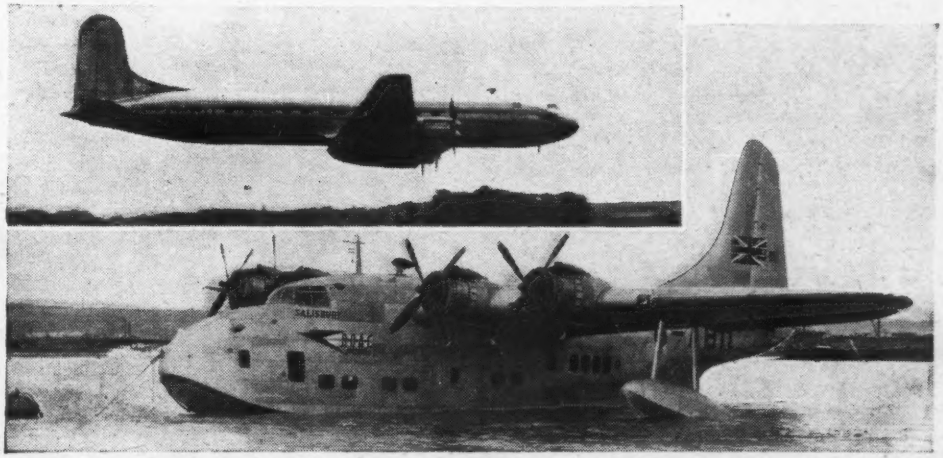
POWER UNITS OF 1946

THE past year has been one of great activity for the manufacturers of power units, and among gas turbines in particular several entirely new designs have made their bow since last January. Many existing piston and gas turbine engines have undergone intensive development, and despite opinions to the contrary, it is apparent that piston engines of all sizes will continue in regular service for at least five years to come.

True, it has now been stated that for military purposes only gas turbines will be ordered in future. The facts remain that a number of excellent piston-engined types are still among our first-line fighters, that all airscrew turbines are still in the development stage, and that, except for fighters, no airframes specifically designed or suitable for pure jet power are as yet past the early experimental stage.

Turning first to the large piston engines, the most important developments concern the Bristol Hercules 230 (civil 730), Napier Sabre VII, and the Rolls-Royce Griffon 130 and Merlin 620. In addition the special coupled Centaurus units for the Bristol 167 prototype are noteworthy. They are two modified type 57s, renamed Type 20, and give, as a pair, over 5,100 h.p.

The Hercules 230, which gives a maximum output of 2,055 h.p., is of 38.7 litres capacity. For an increase in weight of 20 per cent over the early Hercules an improvement in power output of 50 per cent has been achieved. Using 100/130 grade fuel the specific consumption of 0.428 lb/h.p./hr for W.M. cruising is very creditable.



Fast and commodious, the Avro Tudor II (top) is seen demonstrating. Below is the first of twelve Short Solents for B.O.A.C. The Solent is the civil counterpart of the Seaford, delivered to Coastal Command Squadrons during the year.

THE OLD YEAR

Always a most intriguing design in view of its "flat-H" 24-cylinder layout and sleeve valves, the latest Napier Sabre (Mk. VII) was one of the first British units to be rated with water/methanol injection. Its capacity is 36.7 litres and the maximum power is now 3,100 h.p. at 3,850 r.p.m.

Of the latest Rolls-Royce units, the civil 620 has recently received frequent mention in connection with its installation in Douglas DC 4Ms for T.C.A. It is also, of course, the power unit of the Tudors. Its maximum output is 1,770 h.p. at 3,000 r.p.m., and its capacity 27 litres. It is recognized as a particularly well-equipped power unit and is well suited to the demands of transatlantic services.

The Griffon 130, announced at the very beginning of 1946, is remarkable for its power output at altitude. More than 2,000 h.p. is delivered at 21,000ft from this 37-litre engine. The secret lies chiefly in the 3-speed 2-stage supercharger and Rolls-Royce fuel injection system.

With the rigorous duties of transatlantic service in mind, the Rolls-Royce 620 has been designed for high-altitude cruising and all it entails.

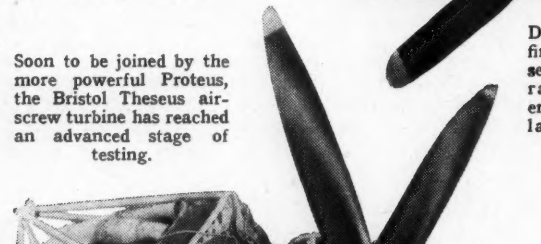
Designers would find it hard to select a cleaner radial piston engine than the latest Hercules, the 630.

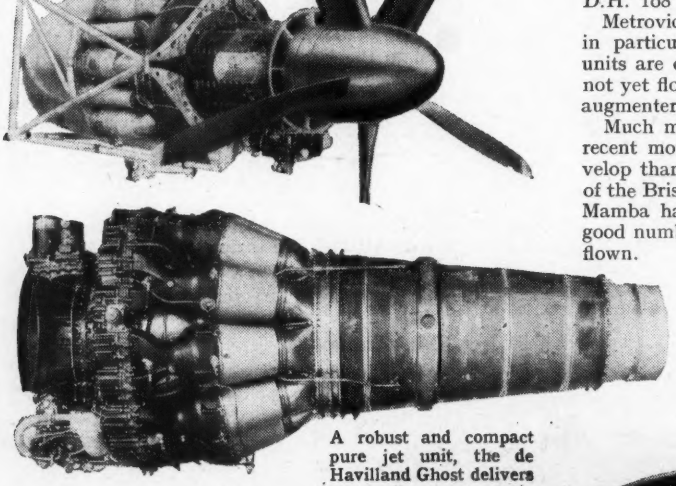
Gas turbines have during the last twelve months emerged in a diversity of layouts and sizes. Rolls-Royce Derwent Vs and D.H. Goblins continued to establish themselves and details of their large brothers, the Nene and Ghost, each giving 5,000-lb thrust, were announced during 1946. An outstanding performance of the year was that of the specially rated Derwent Vs which can claim to have powered the first aircraft to exceed 1,000 k.p.h. It is probable that the special Goblin-powered D.H. 108 is also capable of such a speed.

Metrovick designs have undergone further development, in particular with ducted-fan thrust augmenters. Such units are developing up to 4,600 lb static thrust but have not yet flown. The latest design, the F.5, has an open-fan augmenter.

Much more has been heard of airscrew turbines during recent months. These are naturally taking longer to develop than the much simpler pure jets, and so far details of the Bristol Theseus, and Armstrong Siddeley Python and Mamba have been released. All these units now have a good number of running hours to their credit but have not flown.

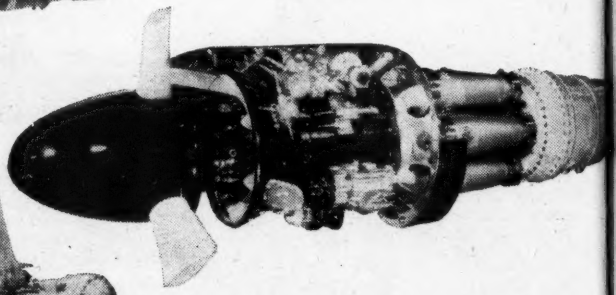
Soon to be joined by the more powerful Proteus, the Bristol Theseus airscrew turbine has reached an advanced stage of testing.

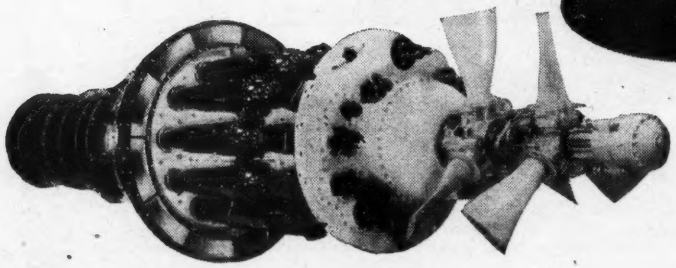




A robust and compact pure jet unit, the de Havilland Ghost delivers 5,000 lb. max. static thrust at 10,000 r.p.m.

(Below) At present in a class of its own, the little Armstrong Siddeley Mamba airscrew turbine gives a "four figure plus" equivalent horse power for a lower installed weight and drag than any other power unit.





(Left) Most powerful British power unit announced to date, the Armstrong Siddeley Python airscrew turbine was developed from the A.S.X. experimental turbo-jet.

The particular features of the Theseus are its heat exchanger, its independent turbines—one two-stage turbine driving the compressor and auxiliaries and a second single-stage turbine for the airscrew—and finally its combination of axial followed by centrifugal compressor. The maximum static sea-level power output is 1,950 s.h.p. plus 500 lb thrust at 8,200 r.p.m.

Great Expectations surround the Armstrong Siddeley Python airscrew turbine announced early in 1946 as the most powerful British aircraft engine to date. At sea-level and 8,000 r.p.m. it can give up to 3,670 s.h.p. plus 1,150 lb thrust. Two Pythons are shortly to commence air tests in the outboard engine positions on a Lincoln.

The second member and newest arrival of this family, the Mamba, is the smallest airscrew turbine at present being developed and gives 1,010 shaft horse power and 320 lb thrust. Like the Python, it has an axial compressor.

Mention must be made of the work of metallurgists in improving constructional material for gas turbines, and in particular of a new material for turbine blades. There has been no change in the aviation kerosene fuel used for gas turbines, but it is possible that blow-out and re-igniting problems which have been experienced at very high altitudes may soon call for the use of a higher grade fuel.

Smaller Piston Engines

Several light engines have been announced, and, as in America, horizontally-opposed layouts seem to be in favour. First examples may reach the flying stage during next year. These include the Fedden 185 h.p. flat-six and the 100 h.p. Nuffield flat-four. Earlier in the year the Jameson flat-four appeared.

Although of pre-war design, the 515 b.h.p. Alvis Leonides has been substantially improved during the year and two are shortly to fly in the prototype Concordia.

In view of the announcements of names and brief details for new designs now on the way, it may be assumed that 1947 will see many new power units. Of special interest will be the new Rolls-Royce designs including the Dart, the Bristol Proteus, and the Napier Niad, to mention but a few.

Another American Amphibian

The Grumman Mallard Eight-ten-seater for Airline Work

ALTHOUGH vague references to Grumman's new eight-to-ten-seater amphibian, the Mallard, have been made from time to time, no full official announcement was forthcoming, since development was being kept quiet until an Approved Type Certificate had been obtained and production plans were well ahead. This procedure is sound and offers a pleasant change from the more usual American method of announcing and booking orders for a new aircraft while it is still in the prototype, or even the project stage. Grummans probably have a fair idea of the likely market for their new Mallard, since they work not through agents or "dealers" but directly with their customers. Expected production before the end of this year is thirty-five towards a total estimated demand for 250 machines. Although the market for such a specialized and somewhat costly type is comparatively small, it is a very definite one, and an amphibian which is both land- and fully seaworthy can fly in areas where air transport is otherwise of the non-stop variety.

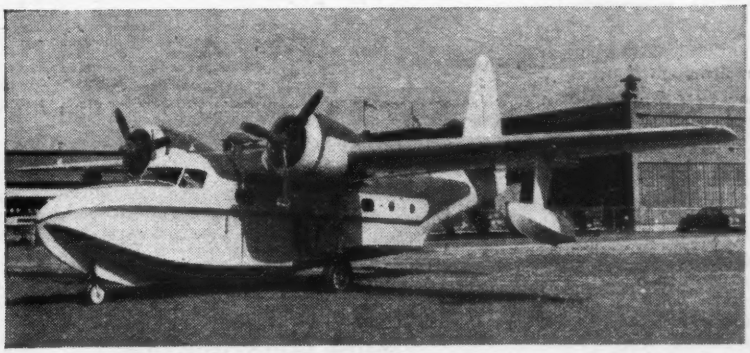
The Mallard is, we believe, the only amphibian so far to have qualified for, and passed, the latest C.A.A. requirements for scheduled airline passenger aircraft, and it has created a new American category for amphibians, namely the civil eight-ten-seater airline type. The only rivals are the smaller and less operationally practical pre-war Goose and Widgeon, which were also built by Grumman.

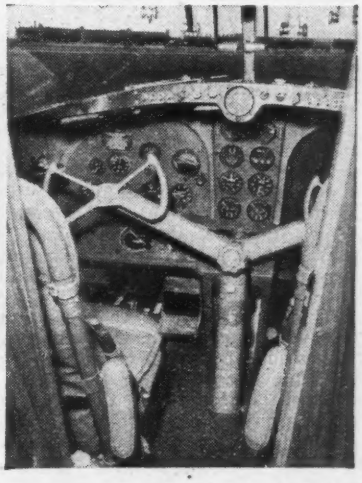
Grumman Aircraft Engineering Corporation, with fifteen years' experience, have brought amphibian construction to a fine point with the Mallard, which has perhaps the best lines of any amphibian so far produced. Full airline equipment, with dual controls, as comfortable an interior as any yet seen on a medium-sized aircraft, tricycle landing gear and a good performance are to be had for a cost of about £22,500. At that figure a fair market should be open—and particularly among the various operators in North America.

If the estimated demand for 250 Mallards is a fair one, it will be interesting to see how the Short Sealand fares in the world's markets.

GRUMMAN MALLARD
Two 600 h.p. P. and W. Wasp H

Span	66ft 8in
Length	48ft 4in
Height on ground	19ft 4in
Wing area	444 sq ft
Gross weight	12,500 lb
Useful load as transport	3,280 lb
Maximum level speed	215 m.p.h.
Range with 8 passengers at 180 m.p.h.	570 miles
Rate of climb (sea level)	1,400ft/min





The 8-10-seater G73 Grumman Mallard amphibian with tricycle undercarriage. On the right is the pilots' cockpit, showing the blind-flying panel and the entrance to the mooring locker. Duplicated radio controls for both pilots are on the upper rim of the instrument panel. The wing-tip floats are non-retractable. Engine controls hang from the roof.

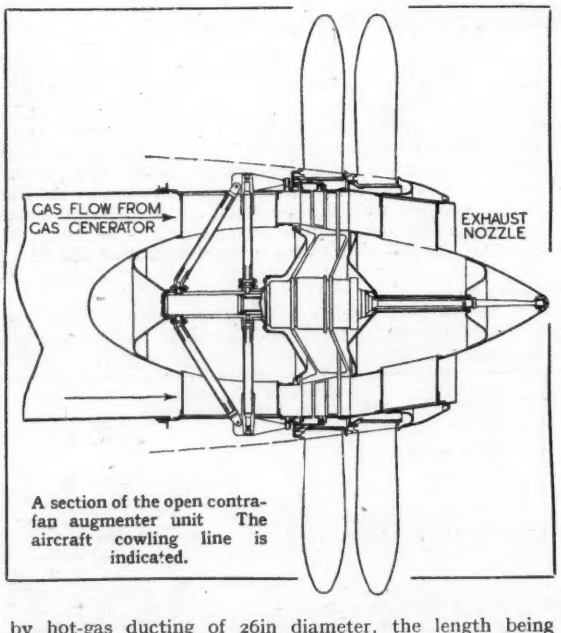
Metrovick F.5

Open-Fan Thrust Augmenter on Standard F.2 Gas Generator

IN view of the controversy concerning the relative merits of turbo-jets and airscrew-turbines and the speeds at which the one would be more efficient than the other for a particular airframe, additional information on a new and alternative half-way arrangement, namely, open-fan augmentation, will be of interest.

Readers will already be familiar with the Metrovick F.3 which embodies a ducted-fan thrust augmenter. The new Metrovick F.5, with the open-fan type of augmenter, was briefly described and illustrated in *Flight* of November 21st and 28th. Basically the F.5 comprises a gas-generator unit as used on the standard F.2 series 4A turbo-jet, and a contra-rotating pusher fan unit, 5 feet 6 inches in diameter, driven by a four-stage turbine. The gas generator weighs 1,600 lb and the augmenter 600 lb. The total represents only a 30 per cent increase in weight over the simple jet unit.

The augmenter unit is connected with the gas generator

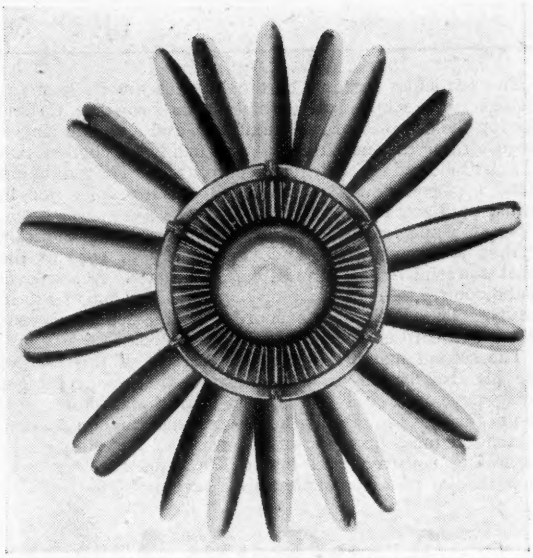


A section of the open contra-fan augmenter unit. The aircraft cowling line is indicated.

by hot-gas ducting of 26in diameter, the length being determined by the aircraft installation, although if necessary the fan turbine can be mounted directly behind the gas generator, thus eliminating the duct altogether.

In the case of the F.5, the augmenter unit is intended to be mounted either at the rear end of the fuselage or behind the trailing edge of a wing. It may be regarded as a contra-rotating, fixed-pitch, multi-blade airscrew with fourteen blades in the front bank and twelve in the rear one. Additional thrust is supplied from the propelling nozzle behind the turbine. The fans are free-running, their speeds being controlled by the balance between their output and the turbine power input.

By comparison with the airscrew-turbine scheme, the open-fan augmenter has the advantage of lightness, simplicity and absence of gearing. Its performance is comparable over a good range of flight conditions, and at the designed point it equals that of the V.P. airscrew. By comparison with the simple turbo-jet, the open-fan augmented unit gives a much better specific consumption



The entry of the contra-fan turbine. There are 14 blades on the front bank of the fan unit and 12 on the rear.

with improved specific weight over a wide range of flight speeds up to 500 m.p.h. The F.5 is approximately 100 lb lighter than the F.3 with ducted fans and gives 100 lb additional thrust. By fitting an adjustable air propelling nozzle the propulsive efficiency of the augmented engine may be maintained at a high level over a greater range of speeds.

Auxiliaries are grouped round an external gear box on top of the intake casing and driven by a vertical shaft. An alternative drive may be fitted at the centre line of the intake casing and adjusted in plan view to suit installation requirements. The unit is started by means of a Plessey petrol engine mounted on the auxiliary gear box. The augmenter is designed to give most economical operation at 400 m.p.h. at maximum continuous rating, and augmentation ratios are relative to the performance of the standard F.2 Series 4A turbo-jet.

METROVICK F.5

Take off power at 75 m.p.h. sea level	fan thrust	2,840 lb.
	jet thrust	1,870 lb.
	total thrust	4,710 lb.
Climbing at 200 m.p.h., 20,000ft	fan thrust	1,850 lb.
	jet thrust	850 lb.
	total thrust	2,700 lb.
Specific fuel consumpt.		0.663lb/hr/lb thrust.
Continuous cruising at 400 m.p.h., 20,000ft	fan thrust	1,670 lb.
	jet thrust	630 lb.
	total thrust	2,300 lb.
Specific fuel consumpt.		0.872lb/hr/lb thrust.
Fuel consumption at continuous cruising conditions		240 g.p.h.
Oil consumption		8 pt/hr.

DIMENSIONS

Gas generator length	12ft 2.25in.
Diameter	37.25in.
Augmenter unit length	4ft 5in.
Diameter (including fans)	5ft 6in.
Diameter blade root fairing	2ft 7.5in.

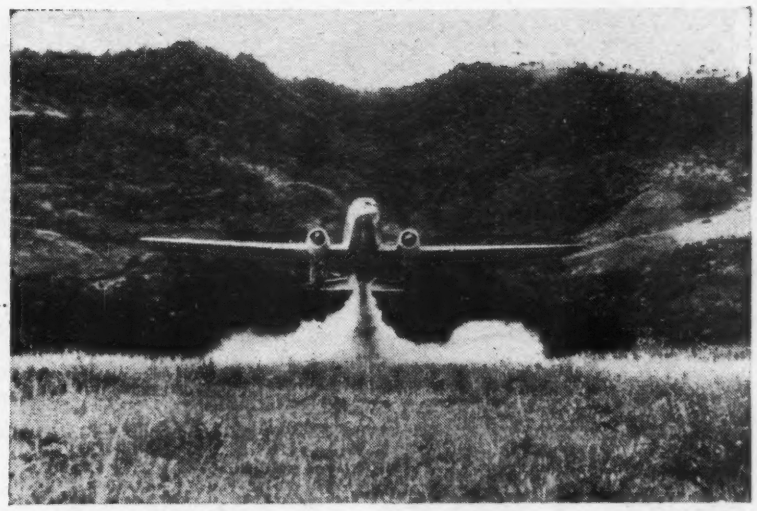
WEIGHTS

Gas generator	1,600 lb.
Augmenter unit	600 lb.
Hot gas duct	15lb per ft.
Rotation (looking forward)	Gas generator clockwise. Front fan Clockwise. Rear fan Anti-clockwise.

VIKING CONSTRUCTION

THE construction of Vickers-Armstrongs Vikings and the production of magnesium-alloy tanks are the subjects of two important series of articles appearing in *Aircraft Production*. First instalments of both articles are included in the January, 1947, issue.

HERE AND THERE



THE ONLY WAY: So hemmed in by mountains is the little airfield at La Cumplida, Nicaragua, that airliners must use rockets to assist take-off. Chief traffic is supplies for the La Luz gold mine.

Prize Picture

A BRITISH photographer, Mr. Cyril Peckham, has won first prize in the black and white professional section of the International Competition for Aviation Photography held by Intava Inc. in New York last month.

His winning picture, "Death's Eye View," was a head-on close-up of a Tempest II just emerged from a cloud bank, taken from a Hart at about 9,000ft. The Tempest was flown by Bill Humble.

Cierva Memorial

AN annual prize of £25 is being offered by the Helicopter Association of Great Britain for an essay or paper of a technical nature on some aspect of rotary wing flight. This will be known as the Juan de la Cierva Memorial Prize Essay.

Competitors must be British subjects, but not necessarily members of the Association, and must be under 35 on December 31st of the year of entry.

Entries for the 1946-47 essay must be in by March 31st next, but full particulars can be obtained from the Association's honorary secretary at Finsbury Circus House, Bloomfield Street, London, E.C.2.

Peace

JUST before Christmas there was a news story about two ex-R.A.F. officers, both of whom had been shot down and taken prisoner early in the war, who were sharing their Yule turkey with four German P.o.W.s from a camp near their home. Their mother said her two boys had themselves suggested thus taking advantage of the relaxed regulations in respect of entertaining German prisoners at Christmas. Doubtless there were other similar instances in various parts of the country, which did not happen to "hit the headlines," and nobody, surely, has better moral right to decide what attitude should be adopted towards our former enemies than our own ex-Servicemen. Many will agree that if lasting peace is to be achieved, then the sooner the hatchet is well and truly buried the better.

Up-to-date Publicity

ONE of the most powerful, as well as the most up-to-date agents of propaganda to-day is the cinema, and there have been some excellent documentary and semi-documentary films made during recent years. The R.A.F. alone have produced several, notably "Target for To-night," and, more recently, "Journey Together," and we have all seen those Ministry of Food and Ministry of Information films—mostly "shorts"—at our local cinemas.

Now the Society of Model Aeronautical Engineers has collaborated with the Norman Film Studios in the production of a documentary which is ready to go on circuit and is being handled by Fox Films.

With a commentary by Lionel Gamlin, this film will also be available to clubs on 16 mm stock.

Rapid Progress

REUTER recently reported an announcement by U.S. Army authorities that a 14-ton rocket of the V.2 type had been launched from the experimental range at Whitesands, New Mexico, and had reached an altitude of 111 miles and a top speed of 3,600 m.p.h.

A rocket travelling in horizontal flight at this speed, they point out, would reach Liverpool from New York in 51 min, or do the London-Moscow trip in 26 min.

It had been hoped, the report continued, to hurl small metal slugs from the nose of the rocket 40 miles above the earth so as to have enough speed to overcome gravity and continue into space.

Next thing we know, we shall be getting a nasty letter from Mars or something!

Far East Conference

WHEN Marshal of the R.A.F. Lord Tedder was on his way back to Britain after his recent tour of R.A.F. bases in the Far East, he conferred with British Service and civilian chiefs in Malaya and South East Asia at Kuala Lumpur, that pleasant Malayan city situated at a comfortably cool altitude about midway between Penang and Singapore and generally referred to as "K.L." by the colonial residents.

The subject of the conference has not, as yet, been disclosed, but it was attended by (among others) Gen. Sir Montague Stopford, the acting Governor-General of Malaya; Mr. F. C. Gimson, Governor of Singapore; and Lord Killearn, British Special Commissioner in South East Asia.

News in Brief

The crew of a British military Anson were unhurt when their aircraft, en route to Copenhagen from London, was badly damaged in a forced landing outside Kastrup Airport just before Christmas.

* * *

A standard Royal Australian Air Force de Havilland Mosquito fighter-bomber has flown from Australia to New Zealand in 3 hr 43 min, bettering the previous record for the transocean crossing by 50 min.

* * *

"Aerotech" Flying Club No. 1 announce that Flt. Lt. Vernon Blunt will be unable to give his lecture on "World Gliding" on Thursday next, Jan. 9th, as advertised, and his place will be taken by Mr. R. G. Worcester who will talk about "Naval Aviation."

* * *

The Rolls-Royce Nene jet unit from the Ministry of Supply exhibition in Charing Cross Underground Station is to be shown at the Empire Exhibition in the Commemorative Pavilion, Sydney, which is to be a feature of the Royal Easter Show to be staged by the Royal Agricultural Society of New South Wales.

* * *

Miles Aircraft, Ltd., are reducing the working week of employees to a 42½ hr. five-day week as from this week-end. Making the announcement recently, Mr. F. G. Miles said he felt sure these benefits would be reflected in increased production.

* * *

Air Chief Marshal Sir Keith Park, who recently retired from the R.A.F., has gone to South America to survey the aircraft industry there. He left London for Buenos Aires on Dec. 20th and will be away for several months.

* * *

Recommendation that cosmic ray research should be supported on a greatly increased scale was made in the report of the British Commonwealth Scientific Official Conference recently published by H.M. Stationery Office (price 1s 3d). The report also suggested that the Air Forces of the Commonwealth should be asked to help in the research work by providing the necessary flying hours.

The Anglo-Italian Airline : Airport Discussions : N. Ireland Council

QGD?: A K.L.M. Skymaster flying over New York. The company intend to fly the better weather route, through Lisbon and the Azores, until April.

CIVIL AVIATION NEWS

IT COULDN'T HAPPEN HERE

Pan American Airways' Case for Flying Domestic Routes

AS a striking contrast to our own monopolistic conception of civil aviation, the Pan American Airways' application to the C.A.B. for permission to fly passengers within the United States is of the greatest interest.

As readers will remember from the short description of American civil aviation organization in *Flight* of September 26th, the C.A.B. is a judicial body upon whom rests the adequacy and general efficiency of American airline operation—but by virtue of policy decisions and not through executive powers. Before any new routes may be opened for scheduled operations the applicant must satisfy the Board that the route is justified and that the company is capable of maintaining a good and adequate service.

The internal, or domestic, services of America are provided by a number of operators, all of whom are permitted to fly only those routes allocated to them. There are three international services—American Overseas Airlines, Trans-World Airlines and Pan American Airways—and, once again, each covers specified routes.

When the case for the allocation of these routes was put before the Board, Pan American favoured the "chosen instrument" principle for external services, and applied for permission to open up all international routes at the exclusion of other operators. On these grounds the company therefore asked to play no part in the domestic field—but they lost their case.

Of the three international airlines, P.A.A. is the only one without an affiliate in the domestic field, A.O.A. and T.W.A. being, in fact, the overseas divisions of American Airlines and Trans-Continental and Western Air respectively. Pan American must, therefore, rely upon other airlines for the carriage of their passengers across the continent and to inland cities. Hence this application to the Board for permission to fly schedules across the American continent connecting the thirteen cities now served by their international air routes.

The issue is a big one and, rather naturally, the application is strongly opposed by the other operators, who consider the routes concerned to be adequately catered for, and that such intrusion would attract too much business away from themselves.

The normal procedure was adopted, and the proceedings before the Board started on November 6th, both the applicant and opposition being represented by counsel. The Pan American case was that there would be improved domestic services from coast to coast and from border to border, as well as improved one-carrier international services, and that the routes would strengthen P.A.A.'s existing system. It was contended also that there would be no adverse effect upon the existing domestic airlines. P.A.A. also hold the view that an approval of the proposed domestic air routes would result in savings for the American taxpayer by helping to eliminate the necessity for subsidizing air routes.

Their intention is to fly between the thirteen cities in long hops, if possible without landing, using thirty-seven Stratocruisers and thirteen Rainbows. Such cross-country routes would close those gaps in the present Clipper system and permit unified maintenance establishments.

Mr. J. C. Leslie, vice-president of P.A.A., gave evidence, and, including the time he was under cross-examination, spent four days in the box. He forecast that a broader operating base would enable the company to operate long overseas "national interest" routes which would not otherwise be commercially profitable. P.A.A. required, he said, a domestic route-network to put their international operations on a firm economic footing. P.A.A. also proposed to fly these domestic routes at a fare 16 per cent under current domestic fares.

Foreign Competition

An interesting point in the proceedings was the warning by Mr. Leslie that America had under-estimated the competition from foreign airlines in international aviation, and he criticized the existing circumstances whereby the foreign airlines were permitted to fly routes across America which were denied to P.A.A. By the terms of the Bermuda agreement B.O.A.C., for example, have the right to fly through to San Francisco.

Much importance is attached to this case in America, and every morsel of evidence and opinion is being argued by both sides. The case is representative of the organization behind civil aviation in America where the endeavour is to maintain domestic and international transport on a fair, efficient and adequate basis, by allotting air routes to those companies most fitted to serve them.

The healthy competitive nature of the system lies in the requirement that every operator must supply proof of past

CIVIL AVIATION NEWS

efficiency and evidence of future ability before extensions may be obtained. The system is apt to break down, however, when foreign airlines are given privileges which have already been mentioned. There is also evidence that this system can lead to considerable waste of effort, and in some cases there is unnecessary competition for individual gain. Many unnecessary miles are flown across America at the expense of the comfort and time of passengers. But the competition is there and expansion may only be obtained through efficiency.

The British and American systems both fall short of the ideal, and yet they are completely conflicting. The Americans, however, are likely to be in a better position for reaching a suitable compromise.

ARRANGEMENT WITH ITALY

WITH the full appreciation that a sound civil aviation organization was essential to recovery in Italy, the Italian Government made it known early last year that assistance from Britain and the U.S. would be welcomed. Discussions were arranged between B.E.A., T.W.A. and the Italian Ministry of Aeronautics. An agreement of ten years' duration was reached which, after ratification by the Italian Council of Ministers, gave effect to the creation of two companies, one with 40 per cent British and the other with 40 per cent American interests.

In order to avoid any monopolistic tendency, the allocation of routes was included—this allocation laying emphasis for the British on external, and, for the United States, on internal services.

The Anglo-Italian company, which was officially formed on September 16th, 1946, with a capital of one million pounds, has been named Aero Linee Italiane Internationali, and should start operations early this year on those internal routes which, by agreement, are to be shared with the United States. The company will link those international airports from which it will operate, i.e., Turin, Milan, Venice and Trieste.

Direction and capital have been divided on a basis of 60 per cent Italian interests, of which 40 per cent are Government-owned and the remainder held by groups of private firms. Six of the ten directors are Italian, with H.E. Sir de Michelis as president. British interests are held entirely by B.E.A., and the four directors are Mr. Whitney Straight, Sir John Serrao, Mr. D. L. Craig and Comdre. Wolfson. It is understood that there has been the utmost co-operation from B.E.A. during the negotiations, which were conducted by Lord Winster and Mr. Ivor Thomas, and the underlying principle of assistance for Italy has been appreciated.

It is the intention that Italian aircraft, staff and labour generally shall be used, and as much Italian equipment as possible, with the idea of getting the factories in action. In cases where this cannot be done British goods will be used—and this will apply particularly to engines. This is the first example of practical assistance to Italy, and will probably have a far-reaching effect on civil aviation in that country. The American company, L.A.I., will probably start operations before A.L.I.I., since they have bought surplus American military aircraft. The routes to be covered by the Anglo-Italian company will include six to various capitals in Europe, and all those between Italy and the British Commonwealth, North Africa and South America.

MARINE BASES

MR. LINDGREN was still unable, on December 18th, to make an announcement on the recommendations of the Pakenham Committee to develop Langstone Harbour as a flying-boat base.

On the subject of adjacent marine and landplane airports, it would be interesting to know whether the Ministry had considered Langford Lodge as a possible airport for Belfast, in preference to Nutts Corner. Developed during the war as an American base, the station has good runways and buildings, excellent approaches, and stands on the banks of Lough Neagh, which has possibilities for flying-boat operations. The airfield is about sixteen miles by road from Belfast, to which it is also connected by rail.

BIRMINGHAM AIRPORT

IN answer to a question on the future of Birmingham Airport, the Parliamentary Secretary to the Ministry of Civil Aviation, gave the reply that Elmdon, which was built before the war, was too small by present-day standards. Plans are being prepared, however, for the extension of one runway, and for the building of another. It is understood that British European Airways intend to operate a number of services through Birmingham, including some direct services to the Continent. Pending completion of the work at the airport and the resumption of services with Vikings, Mr. Lindgren found it impossible to forecast when these services would start.

AIRPORT MANAGERS' CONFERENCE

THE Minister of Civil Aviation called together in London, just before Christmas, some thirty airport managers to discuss domestic problems concerning airport operations, the organization of the Ministry of Civil Aviation headquarters and the proposed Divisional headquarters. Mr. A. H. Wilson, the Under-Secretary responsible for the Aerodromes Division of the Ministry, presided.

Apart from discussing current and future developments at airports, the meeting was valuable in bringing managers into direct contact with those technical and administrative experts with whom they have official business. The agenda also included discussion on M.C.A. relations with the Press and the public, with special reference to the amenities to be provided at airfields for passengers and the public, and the methods of disseminating information generally. Consideration was given to the publication of a new edition of *The Air Pilot*. The managers were given information on the way in which technical standards were settled for the development of airports, and on the present policy for airfield lighting and the provision of mechanical transport. There were discussions also on fire-fighting, rescue and first-aid services, and snow clearance. Another subject of some importance was the relationship between M.C.A. airport staffs and the operators of club and private aircraft using State airfields, and what ground assistance should be given to private owners and casual users.

An outline was given of the current

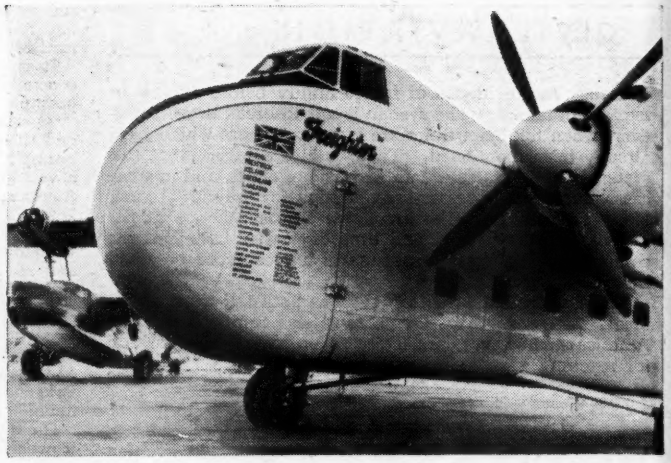
K.L.M. BRIEFING : The blind-landing systems of all major airports used by K.L.M. have been reproduced, and pilots are periodically checked on the "Link" for local knowledge and accurate blind flying. Mr. Martin Henry, Chief Link Instructor, is shown here briefing Capt. V. de Vaart, Capt. A. Viruly, Senior Pilot, and Cdr. Peetoom.

CIVIL AVIATION NEWS

developments which are aimed at encouraging private civil flying, and included an explanation of the policy of affording maximum facilities for all, consistent, of course, with safety in the air. At all airports except those used almost exclusively by scheduled services private flying is to be encouraged.

It is understood that a number of practical suggestions made by managers will be considered. Perhaps the airport managers were able to bring to the notice of the Minister the impotence of their position. At our airports we have, under the present system, a trio of ministerial servants with equal powers—the flying control officer, the signals officer and the manager.

That each airport would be controlled by one Aerodrome Officer was provided for in the Civil Aviation Act, and it was also mentioned by Sir Henry Self in his lecture in September. Perhaps the appointment of Air Vice-Marshal Sir J. H. d'Albiac as the Commandant at London Airport, announced last week, is an indication that the rest of the appointments will soon be made. In the meantime the airport managers at other airports in the United Kingdom remain as nothing more than administrators with very limited powers. The intention of the Ministry to make airports places of interest to the community is good, but the success of such schemes will depend largely upon the imagination, initiative and executive powers of those in command at these airports.



MORE THAN HALF WAY: The Bristol Freighter, which is on a 22,000-mile tour of the Americas, photographed in the West Indies on its way south to Santiago, which will be the official terminal of the flight. The names on the nose include Montreal, New York, Chicago, Vancouver, San Francisco, Mexico City and Habana. On the left is a Supermarine Stranraer on a beaching trolley—presumably one of those still being flown by the R.C.A.F.

NORTHERN IRELAND ADVISORY COUNCIL

AFTER consultation with the Government of Northern Ireland and with Lord Nathan, the Minister of Civil Aviation, Sir Harold Hartley, chairman of B.E.A., has appointed the members of the Northern Ireland Advisory Council. Mr. W. A. Edmenson has accepted the chairmanship of the Council and also an invitation to be a member of the board of British European Airways. Mr. Edmenson has, in the past, been closely connected with cargo shipping, and during the last war was the representative of the Ministry of Transport in Northern Ireland.

The other members are: Air Comdre. Churchman, formerly A.O.C. Northern Ireland and now Chief Inspector in the Northern Ireland Ministry of Health and Local Government; Sir Basil Macfarland, Mayor of Londonderry; Mr. J. P. Mackie, director of a Belfast textile engineering company; Mr. George Porter, of the National Federation of Building Trades Operatives; and Mr. F. Storey, chairman of the Northern Ireland Tourist Association. The terms of reference of the Council will be to advise B.O.A.C., B.E.A.C. and B.S.A.A.C. on civil aviation matters affecting Northern Ireland. The Council has right of access to the Minister of Civil Aviation if necessary.

BREVITIES

From recent checks the de Havilland Company have timed the removal and fitting of a new Gipsy Queen engine into a Dove aircraft, complete with airscrew change, to take only 1 hour and 10 minutes.

* * *

Mr. Knud Lybye has gone to Stockholm to act as Chief Assistant to Mr. Per Norlin, President of Scandinavian Airlines. Prince Axel of Denmark has been named as the new President of D.D.L., the post from which Mr. Lybye has just resigned

* * *

Dr. Lawrence C. Tombs has resigned his position as secretary of I.A.T.A. in order to resume his duties as vice-president of his own shipping company. Mr. Thomas W. Caffey has been appointed the new secretary of the I.A.T.A. Legal Committee and Major H. G. Clusy, of Paris, is to be assistant secretary to the I.A.T.A. Technical Committee.

* * *

Trans-Australia Airlines have ordered five Consolidated Vultee 240s. Deliveries are expected for the middle of this year. The 240 is normally a forty-passenger transport, the prototype of which should be flying very soon—if it has not already flown.

* * *

The first meeting of the South Pacific Air Transport Council was due to start on December 17th at Canberra. Australia was to propose the setting up of a permanent secretariat to continue the work of the Council.

* * *

In addition to the South Pacific Air Transport Council mentioned above, three other important conferences will be held in Australia early this year. The Commonwealth Air Transport Council was due to open this month; the South Pacific Regional meeting of P.I.C.A.O. on February 4th, in Melbourne; and, finally, the I.A.T.A. conference in Sydney on January 14th.

British European Airways have moved their offices from 16, Upper Grosvenor Street, to Nos. 6, 8 and 10, Hill Street, W.1.

* * *

Vancouver deals with nearly twenty-five per cent of the total air traffic in Canada. During August more than 15,000 landings were made at the city's airport.

* * *

The Republic Aviation Corporation hope to make an attempt this summer at a record flight round the world. The estimated time for the trip is 46 hours, and stops are expected to be made at Paris, Karachi, Tokio and Alaska.

* * *

Brigadier C. G. Ross, the director-general of civil aviation in South Africa, arrived in England last week after visiting the United States and Canada. The Brigadier took the opportunity of making a special visit to Prestwick.

* * *

Mr. R. W. Ryan has been made general manager of operations for Canadian Pacific Airlines in Winnipeg, and Mr. C. H. Dickins is the new director of research for the company at Montreal.

* * *

The prototype S.A.A.B. Scindia transport, which was described in *Flight* of November 14th, has now made its first flight. This P. & W.-engined tricycled 24-32-seater has a cruising speed of 222 m.p.h. and good low-speed and asymmetric characteristics.

* * *

Notice to Airmen No. 217 announces that the Bush Mills Consol Station is now in continuous operation throughout the twenty-four hours with the exception of a break in transmission of fifteen minutes between 1500 hours and 1515 hours each day for routine maintenance. It is at present transmitting an R.A.F. call sign. Early this year, when the M.C.A. take over control of the station, a civil call-sign will be used. This change-over will be announced in a subsequent *Notice*.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ULTRA LIGHT AIRCRAFT

Political Motive for Discouragement

IF your correspondent Mr. Clegg (*Flight*, December 19th) would study the objectives of those who control the political and economic destiny of Great Britain and her Empire, starting with C. H. Douglas's "Brief for the Prosecution," he would understand that the discouragement of civil flying, ultra-light and otherwise, is not as crazy as it at first appears. It is one means by which to destroy our inheritance of air supremacy towards the establishment of the Big Idea of a World State controlled by a World Government enforced by a World Police Force with propaganda by a UNO what—the ideal of most Internationalists and well-meaning, if misguided, Federal Unionists who are among its most enthusiastic supporters.

D. USHER.

NAVIGATIONAL STANDARDS

W/T Operation is Poor

THE Civil Air Ministry of to-day appears to have little regard for the efficiency of what is still our major aid to aerial navigation—the radio operator.

The W/T operating standard both in the air and at Ministry of Civil Aviation ground stations is poor. An improvement would make for safer flying and simultaneously ease the control situation.

This was proved in pre-war days when stiffening of the Air Ministry radio examinations resulted in an excellent standard of air and ground operating. Croydon control then managed to cope with peak traffic satisfactorily, and more aircraft were handled with fewer delays and complaints than is done to-day.

If the lowering of examination standards is a result of pressure from the airlines and/or charter companies, this is surely a short-sighted policy and one which calls for protest from the British Airlines Pilots' Association and from the Radio Officers' Union.

NORMAN VAUGHAN.

ENCOURAGEMENT FOR FOOLS

Clearing Up a Slight Misconception

PLEASE allow me, with reference to Mr. Clegg's letter in *Flight*, Nov. 14th, to correct an erroneous impression that I have relinquished my efforts to form an association of auxiliary sailplane enthusiasts; such is not my intention. Some applicants to me are obviously confusing an enthusiasm for ultra-light aircraft with an interest in auxiliary sailplanes, and I have been able to refer some of the former to Mr. Clegg.

It is my hope to establish a distinct and separate movement centred solely on controlled soaring flight with the power unit used intermittently—for initial take-off and regaining lost height—thus divesting orthodox soaring of its drawbacks. Our model is the Carden-Baynes auxiliary sailplane introduced by the late Sir John Carden, whose pioneer developments made no pretence of being in the ultra-light aircraft category.

Perhaps somewhere in the world there is one of these Carden-Baynes auxiliary sailplanes available whose owner might consider disposal, loaning, or allowing inspection for club purposes, inexpensively? If so I would gratefully acknowledge response to me, c/o London Savings Bank, 144, High Holborn, W.C.1.

D. USHER.

PILOTS' LICENCES

Taxi and Charter Operation

THE writer of "Airline Pilot" in *Flight*, December 5th, reports anticipated revision of "B" licence examinations.

For purposes of ensuring only capable hands at the helms of public transport this move is obviously overdue if anything, and all with the welfare of civil aviation at heart welcome the opportunity of a clean start on up-to-date lines.

My only fear is that another "little man" may be drowned in the new flood of requirements, restrictions and modifications that will follow this adaption of the old to the new.

The "B" licence as it stands covers both the airline pilots as mentioned by "G. M. M.," and the bread and butter pilot of the "flying taxi" type, the small charter flight operator with one or perhaps two *light* aircraft!

His customers are not the type to want to "press on" to Timbuctoo in the face of hail, fog and gales, or for that matter to travel by night (even if his aircraft and home airfield *did* have night flying facilities!) The airfields this pilot will visit are not likely to have any form of rigid or semi-rigid control, by visual or radio methods.

Instrument flying and "met" are also lesser bugbears—I will not say unnecessary—but his passenger will want to fly from A to B mostly for convenience and largely for pleasure. Convenience will not be dictated to by fog and poor visibility, gales and line-squalls; either it can or cannot be done by air, and if there is doubt the customer goes by train.

Pleasure likewise recognizes blue sky and sunshine as its ultimate aim, and will not require braving the elements to fulfil its momentary whim.

Chart tables C. of G. and other matters of notable importance are hardly likely to affect the taxi pilot either. He has no room for a chart table anyway, and it would be rarely necessary to carry more than the local topographical sheet (with its pencilled-in improvements!), while the light aircraft's seating accommodation offers little enough scope for wandering, so the C. of G. will not fluctuate a great deal unless some innocent old lady expects him to compete with the furniture removal firms!

Surely it would be like asking the captain of the *Queen Elizabeth* and the skipper of the "trip round the bay in the Skylark" to fulfil the same requirements in all things, as to put the taxi pilot of a light 2-3 seat aircraft through an airline pilot's examination. There must be a series of licences or a waiving of regulations will surely follow, and I contend that a useful function is, and will be for a long time filled by this small charter type of business; all the licence this really requires would easily be covered with a suitable endorsement to an "A" licence, leaving the "B" licence to be graded and classified to the multiple requirements of airline work!

"474."

AIR EFFICIENCY AWARD

Some More Service Anomalies

THE conditions governing the grant of the above award to non-flying personnel who were in the Auxiliary Air Force or the R.A.F.V.R. before September, 1939, appear to need revision, as the person who joined these services is penalized as compared with his contemporary who joined the Territorial Army at the same time.

War service counts double for the pre-war Territorial for the award of his Efficiency Medal, and in consequence pre-war Territorials who have served throughout the war are wearing the appropriate ribbon, but no such arrangement has been made for the award of the Air Efficiency Award to pre-war members of the A.A.F. or the R.A.F.V.R.

Still another aspect of the case is the Territorial who transferred to the R.A.F.V.R. and in consequence finds himself entitled to neither award, while had he remained with the Territorials he would now have been entitled to the T.A. Efficiency Medal. It is also of interest to note that service in the Army Cadet Force counts as half time.

It is also interesting to note that the award of the Efficiency Medal is also open to pre-war A.T.S., but the same recognition is not open to those W.A.A.F. who were in the R.A.F. companies of the A.T.S. and who were automatically embodied in the W.A.A.F. on its formation.

In fairness it seems that the members of the auxiliary services to the R.A.F. should be on an equal footing to the Territorials in this matter, and they covet the opportunity to qualify for their Efficiency Award on equal terms as an indication that in peacetime they prepared for the "emergency."

SERVING VOLUNTEER.

[War Service for pre-war Air Force reservists already counts time and a half towards the ten-year qualifying period, and according to K.R.s and A.C.I.s "the conditions applicable to officers and airmen of the Auxiliary Air Force and R.A.F.V.R. whose service commenced on or after the 4th September, 1939, and who continue in the post-war non-regular Air Force, will be determined after the conclusion of hostilities." The subject is at present under review and a decision may be published during the next week or two. Those concerned are to be notified.—ED.]

SERVICE AVIATION

MAKING TRACKS: The aerobatic path of a Hawker Tempest II (Bristol Centaurus) is marked by wing-tip vortices.

Royal Air Force and Naval Aviation News and Announcements

New Secretaries

MR. PHILIP NOEL-BAKER, Secretary of State for Air, has appointed Mr. J. S. Orme, O.B.E., to be his private secretary, and Mr. Kenneth Younger, M.P., to be his Parliamentary Private Secretary.

Mr. Geoffrey de Freitas, Under-Secretary of State for Air, has appointed Mr. J. Millson to be his private secretary. In the absence of Mr. Frank Beswick, M.P., Wing Commander E. A. A. Shackleton, O.B.E., M.P., is acting as Parliamentary Secretary to Mr. de Freitas.

Admiralty Appointment

THE following appointment has been approved:

Rear-Admiral G. E. Creasy, C.B., C.B.E., D.S.O., M.V.O., to be Rear-Admiral Aircraft Carriers and Air Stations, British Pacific Fleet and East Indies, in succession to Rear-Admiral A. R. M. Bridge, C.B.E., to date February, 1947.

Admiral Creasy, who held the appointment of Rear-Admiral Submarines, was the youngest Rear-Admiral when promoted to that rank in July, 1943.

He was Director of Anti-Submarine Warfare at the Admiralty from September, 1940, to August, 1942, at the time when U-boat warfare and the Battle of the Atlantic was reaching its peak. For his work while holding this appointment Admiral Creasy was awarded the C.B.E. in the New Year's Honours List of January, 1943.

In September, 1942, he was appointed in command of the battleship H.M.S. *Duke of York*, and later became Chief Staff Officer to the late Admiral Sir Bertram Ramsay during the invasion and the liberation of Western Europe. More than any other one man he was responsible for the detailed naval operational planning which preceded D-Day. In September, 1944, he became Rear-Admiral (Submarines).

Born in October, 1895, Admiral Creasy entered the Royal Navy as a cadet in September, 1908. He is a specialist Torpedo Officer, and during the first World War served in H.M. ships *Conqueror, Lively, Milne, Recruit* and *Nonsuch*.

During the early part of the Second World War he was Captain (D) One in H.M.S. *Grenville;* and in 1940 he was awarded the D.S.O. for successful destroyer operations. After the *Grenville* was sunk he took command of H.M.S. *Codrington*, in which ship he brought Princess Juliana and Prince Bernhard safely to England. He then joined the Admiralty as Naval Assistant to the First Sea Lord and later became Director of Anti-Submarine Warfare, which appointment he held for two years.

In 1942 he was appointed a Commander of the Order of Orange Nassau, conferred on him by the Queen of the Netherlands, and was also awarded the Order of Polonia, 3rd Class, by the President of the Polish Republic, in recognition of his services to the Polish Navy.

Dakota to the Rescue

FLT. LT. W. DRINKELL was called from his bed at Iwakuni after midnight recently and told that Miho Station, 120 miles away, had urgently requested transport for an Indian Serviceman. A few hours' delay might mean the difference between life and death. Because of night-flying hazards Flt. Lt. Drinkell called for a volunteer crew and took off with Flt. Lt. John McMillian and F/O. Peter Foy. On the return journey Flt. Lt. Drinkell, acting

RANK ABBREVIATIONS

A LIST of official abbreviations of R.A.F., A.A.F. and W.A.A.F. ranks has now become available. After careful consideration *Flight* has decided not to adopt this without amendment because in certain instances there is a danger that a contraction denoting a rank may be confused with initials. Thus, in many cases, an oblique stroke has been introduced (e.g. F/O) as a safeguard. Henceforth we propose to standardize the contractions set out below. The list is a long one, as it incorporates the new aircrew categories and ranks.

In future, notices in the *London Gazette* concerning appointments, etc., will show rank titles in full.

OFFICERS

Marshal of the Royal Air Force ...	In full.
Air Chief Marshal ...	In full.
Air Marshal ...	In full.
Air Vice-Marshal ...	A.V-M.
Air Chief Commandant, W.A.A.F. ...	In full.
Air Commodore ...	A. Cdre.
Air Commandant, W.A.A.F. ...	In full.
Group Captain ...	G/C.
Group Officer, W.A.A.F. ...	G/O.
Wing Commander ...	W/C.
Wing Officer, W.A.A.F. ...	Wg/O.
Squadron Leader ...	S/L.
Squadron Officer, W.A.A.F. ...	Sq/O.
Flight Lieutenant ...	F/L.
Flight Officer, W.A.A.F. ...	Flt/O.
Flying Officer ...	F/O.
Section Officer, W.A.A.F. ...	S/O.
Pilot Officer ...	P/O.
Assistant Section Officer, W.A.A.F....	A.S/O.

WARRANT OFFICERS

Warrant Officer ...	W/O.
Master Pilot ...	M. Plt.
Master Navigator ...	M. Nav.
Master Signaller ...	M. Sig.
Master Engineer ...	M. Eng.
Master Gunner ...	M. Gnr.

NON-COMMISSIONED OFFICERS

Flight Sergeant ...	F/S.
Pilot I... ...	Plt. I.
Navigator I	Nav. I.
Signaller I	Sig. I.
Engineer I	Eng. I.
Gunner I	Gnr. I.
Sergeant	Sgt.
Pilot II	Plt. II.
Navigator II	Nav. II.
Signaller II	Sig. II.
Engineer II	Eng. II.
Gunner II	Gnr. II.
Corporal	Cpl.
Pilot III	Plt. III.
Pilot IV	Plt. IV.
Navigator III ...	Nav. III.
Navigator IV... ...	Nav. IV.
Signaller III	Sig. III.
Signaller IV	Sig. IV.
Engineer III	Eng. III.
Engineer IV	Eng. IV.
Gunner III	Gnr. III.
Gunner IV	Gnr. IV.

AIRCRAFTMEN AND AIRCRAFTWOMEN

Leading Aircraftman	L.A/C.
Leading Aircraftwoman	L.A/C.W.
Aircraftman 1st Class	A/C.I.
Aircraftwoman 1st Class	A/C.W.I.
Aircraftman 2nd Class	A/C.2.
Aircraftwoman 2nd Class	A/C.W.2.
Cadet Pilot	Cdt. Plt.
Cadet Navigator ...	Cdt. Nav.
Cadet Signaller ...	Cdt. Sig.
Cadet Engineer ...	Cdt. Eng.
Cadet Gunner ...	Cdt. Gnr.
Aircraft Apprentice...	App/Air.
Administrative Apprentice	App/Admin.

SERVICE AVIATION

on the advice of a medical orderly, kept his Dakota low along the dangerous winding valleys.

A few weeks ago Flt. Lt. Drinkell led three Mustangs to safety after they had been lost in a very heavy fog.

Sutton Coldfield Wins Trophy

PRIDE in the messing conditions of the Service has always been encouraged in the R.A.F. and in recent years interest has been stimulated by the R.A.F. Dining Hall Competition for the silver challenge trophy presented by Captain R. L. Jolliffe, a member of the council of management of the Hotels and Restaurants Association of Great Britain and honorary catering advisor to the Royal Air Force. The judges make their visits unannounced.

This is the fifth year of the competition and the winners are Sutton Coldfield, R.A.F. Maintenance Command Station, with 98.9 per cent marks, Kinloss (Coastal Command) being second with 95.9 per cent, Chilmark (Maintenance Command) third with 95 per cent, and Hereford (Technical Training) fourth with 92 per cent.

Appointment

THE Air Ministry announces the following R.A.F. appointment:—Air Comdre. Allan Lancelot Addison Perry-Keene, O.B.E., to be Air Officer-in-charge of Administration, Air Headquarters, India, with the acting rank of A.V-M.

A.V-M. Perry-Keene has been Air Officer Commanding No. 3 Indian Group, India, since June, 1946, and was formerly A.O.C. No. 4 (Indian) Group and of No. 227 Group, Air Command, South-East Asia. From March, 1943, to November, 1945, he was Director of Ground Training at the Air Ministry, in which capacity he took a leading part in the planning of the Educational and Vocational Training Scheme. In 1942 he was Senior Air Staff Officer first at the Headquarters of No. 221 Group in Burma and afterwards at Air Headquarters, Bengal.

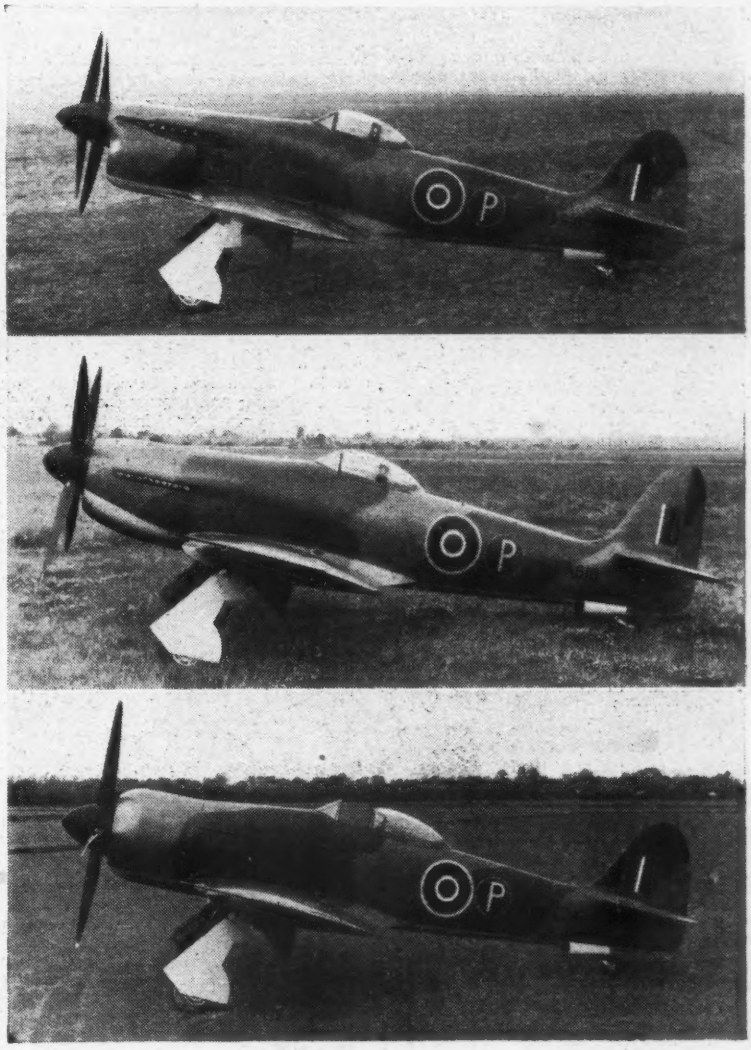
He was granted a permanent commission in the R.A.F. in 1919 after serving in the R.F.C.

Education in the R.A.F.

WHEN the Education and Vocational Training Scheme (E.V.T.) of the R.A.F. closed down on December 31 educational facilities were not impaired, and officers and men will still be able to train themselves for civilian life and generally improve their education. The General Education Scheme for the R.A.F. will be extended, and will take up the threads and absorb any outstanding commitments of E.V.T.

It has been decided by the Air Council that much of the work previously done by E.V.T. will become a permanent part of the General Education Scheme's curriculum. The pre-vocational training side, for instance, will be stressed so that the requirements of National Service and Short Service personnel may be met. In addition to the E.V.T. commitments, the General Education Scheme will provide for the study of all subjects of general education, the study of current affairs and citizenship, and will encourage cultural activities and profitable hobbies.

The General Education Scheme will be staffed by Education Officers at R.A.F. Command Headquarters, Group Headquarters and Stations, but part-time teachers, lecturers, civilian educational institutions as well as correspondence schools will be used to supplement the efforts of these officers.



TRIPLETS: Three prototypes of the Hawker Fury. Top, with liquid-cooled Rolls-Royce Griffon; centre, with liquid-cooled Napier Sabre; bottom, with air-cooled Bristol Centaurus. The Sea Fury X a'so has a Centaurus.

R.A.F. Regiment to Train at Sandhurst

THE latest news concerning the R.A.F. Regiment is that by agreement between the Army and Air Councils, cadets for permanent commissions in the R.A.F. Regiment will be trained at the Royal Military Academy, Sandhurst, after about six months' recruit and gunner training. This has been agreed in the interests of economy and efficiency and to foster an inter-Service spirit. The first course begins at Sandhurst in August next year.

Successful candidates will pay no fees but will be enlisted and paid in the R.A.F. as regular airmen. During the course they will have the status of Officer Cadets and if successful at the end will be granted permanent commissions. The training at Sandhurst, lasting approximately 18 months, will include subjects such as science, history, military tactics, and the use of weapons.

The R.A.F. Regiment offers a wide variety of work at home and overseas and is primarily concerned with the local defence of R.A.F. stations against ground and low-level air attack and with maintaining ground combat efficiency throughout the Service. Officers will also have the chance to serve in native levies. In addition they will take over certain administrative posts held until now by General Duties officers. Armoured, light A.A. and rifle squadrons will be maintained at home and overseas as a permanent part of the R.A.F.

Candidates will enter through the Ser-

vices Entrance Examination held in December and June each year, and conditions of entry are similar to those applicable for entry to the R.A.F. College. That is, they must be unmarried, between the ages of 17½ and 19, and must have reached School Certificate standard. Men serving on regular or non-regular engagements who fulfil the conditions are eligible to apply, as well as men in civil life. If successful in the written and medical examinations, applicants will appear before a R.A.F. Selection Board.

A.T.C. Consultative Committee

LOCAL A.T.C. committees now have direct representation on a new committee—the A.T.C. Consultative Committee, set up as a means of keeping the Air Ministry informed as to the general feeling amongst the A.T.C. members and of enabling those who organize A.T.C. Units to know the long-term plans the Ministry has for the Corps. Great importance is attached to the views of parents, with whom the local representatives will be in touch. Mr. Philip Noel-Baker, the Secretary of State for Air, addressed a meeting of the new committee on December 11th.

Chairman of the committee is the Member of the Air Council for Personnel, Air Chief Marshal Sir John Slessor. Members are: Ten representatives of A.T.C. local committees from each reserve group in England, Wales and Northern Ireland; the Chairmen of the A.T.C. Central Council of Welfare, the A.T.C. Chaplains' Advisory Committee and the A.T.C. Educational Advisory Committee; a representative of the A.T.C. Advisory Council for Scotland and of the Scottish Welfare Council; representatives of the Council of County Territorial Associations and of the Air League of the British Empire; the Air Officer Commanding-in-Chief, Reserve Command, Air Vice-Marshal Sir Alan Lees, who is responsible for the over-all organization of the A.T.C., and representatives of the manning, training and other Air Ministry departments concerned.

Speaking on December 11th, Mr. Noel-Baker said there was in some quarters a rather defeatist attitude about the A.T.C., which he did not share. The functions of that Committee showed that the A.T.C. had real and lasting importance. In future the A.T.C. would be administered by Reserve Command and its training would be closely integrated with that of the Auxiliary Air Force and the R.A.F.V.R. But it was extremely important that not only Service ideas should be brought into its administration and the Consultative Committee could play a very important rôle in helping to administer it. They must try to dispel the conception that in the future the A.T.C. was going to be anybody's child and that the Air Ministry had lost interest in it. That that conception was untrue he had already learned in the short time he had been at the Ministry, which meant to do all it could to give practical support to the A.T.C.

SERVICE AVIATION

Surveyors and the Service

AT the golden jubilee dinner of the junior organization of the Royal Institution of Chartered Surveyors on December 10th, Mr. Geoffrey De Freitas, M.P., Under-Secretary of State for Air, said that land surveyors and valuers, quantity surveyors and pure surveyors, played a great part in the work of the Royal Air Force during the war.

It fell to land surveyors and valuers to do a vast amount of negotiating in the settlement of claims in many parts of the world. He referred to a negotiation in which a Land Officer settled a case of an aircraft crashing on a tent in Saudi Arabia and killing the bread-winner of the family. Great initiative was shown by the officer and international harmony was preserved by his successful persuasion of the wife that full compensation for the loss of her husband could be settled on the basis of 14 female camels. Camels were not acceptable to claimants in this country, but Land Officers were equally successful. Although 123,000 notices were served on owners and occupiers, in only a small fraction of 1 per cent of these cases were there disputes which had to be referred to the General Claims Tribunal. Quantity surveyors from 144 firms worked in building stations and runways to a value of over £330,000,000.

When it became urgently necessary to construct a vast ammunition depot at Fauld, surveyors worked underground before the rubble had been removed or a ventilating shaft installed. In one-eighth of the normal time they had produced a report.

Badge of No. 38 (Bomber) Squadron, R.A.F. "Ante Lucem" (Before the Dawn).

Badge of No. 60 (Bomber) Squadron, R.A.F. "Per Ardua ad Aethera Tendo" (I Strive through Difficulties to the Sky).

Badge of No. 39 (Bomber) Squadron, R.A.F. "Die Noctuque" (By Day and Night).

Permanent R.A.F. Commissions

THE latest list of officers selected for permanent commissions shows that 75 out of 122 officers selected are for the new Technical Branch. Almost all of the 122 officers had previously been selected for extended service commissions. The following officers have been selected:

G.D. BRANCH.

Sqn. Ldr. F. Rothwell, D.F.C.

Flt. Lts. C. P. H. Kunkler, F. J. Trueman, D.F.C.

TECHNICAL BRANCH.

Group Capt. G. W. J. Cozens.

Wing Cdrs. A. E. Dunlop, O.B.E.; J. E. Holliwell, M.B.E.; H. H. Sims; S. G. Taylor; C. Tompkins, O.B.E., A.F.M.

Sqn. Ldrs. W. S. E. Allen, M.B.E.; W. H. Brooks; D. T. Brown; R. D. Carter; W. J. P. Cunningham; C. E. Denning; B. E. Dunkley; P. J. Dunlop; T. U. Dunn; R. G. Enticknap; C. A. Fiddick; P. O. Gibson; F. Healey; H. H. Horsham, M.B.E.; E. T. McCabe, O.B.E.; J. D. de S. McElwain; D. B. G. Miles; C. E. T. Mugford; C. H. O'Leary; F. W. Otter, A.F.M.; W. R. Owen, M.B.E.; I. A. Parry; S. A. Rance; A. McK. Thomson; H. L. E. Watson; T. Wharton; J. E. Wood.

Flt. Lts. F. Allsopp; J. R. Baxter; W. T. S. Brain; A. W. S. Brown; C. W. Buckingham, M.B.E.; L. E. S. Cowan, D.F.M., B.E.M.; P. J. Crowley; F. J. Culliford; I. J. de la Plain; D. S. Eburne; A. B. Ellender; H. G. Gardener, M.B.E.; G. S. Gee; M. Greenwood; D. F. Handel; G. B. Harding; P. E. Hope; P. G. S. Jackson; S. S. King; W. L. McAllister; J. MacRae; J. K. Pilcher-Clayton; F. R. Pope; C. F. Povey; N. J. Rowe; K. A. Sharpe; J. A. Sheppard; R. F. Taylor; K. I. Thomas, M.B.E.; W. Turner, G.M.

F/O.s R. H. Anderson; W. J. Bishop; J. I. R. Bowring; W. J. Brenton; L. S. Denyer; D. Duncan; A. C. Michelmore; R. W. M. Sennitt; M. G. Spencer; J. A. G. Tucker; C. F. Wilkinson; G. Young.

A. & S.D. BRANCH FOR SECRETARIAL BRANCH.

Group Capts. R. A. R. Coote-Robinson; G. P. S. Pollard, O.B.E.; F. J. Taylor, C.B.E.

Wing Cdr. E. V. Masters, M.B.E.

Sqn. Ldr. N. Welch.

EQUIPMENT BRANCH.

Wing Cdrs. H. E. Campbell-Orde; R. W. Clark; N. E. de Gruchy, B. B. Johnson; F. H. Kelly, M.B.E.; W. D. Symes.

Sqn. Ldrs. F. K. Axten; P. J. Bleeck; J. E. Butland; F. P. Connolly; H. E. Hill; W. A. J. Iles; W. Kemplay; A. C. Leeson; D. P. Matthews; G. F. Stevens; J. K. Turnbull.

Flt. Lts. P. J. Gohery; S. R. Lewis; A. C. Marfleet.

MEDICAL BRANCH.

Wing Cdr. W. C. Baird, M.R.C.S., L.R.C.P.

Sqn. Ldrs. M. W. Arthurton, M.B., B.S., M.R.C.S., L.R.C.P.; A. C. Camm, M.R.C.S., L.R.C.P.; J. M. Ferguson, M.R.C.S., L.R.C.P.

DENTAL BRANCH.

Wing Cdr. V. H. Weeks, L.D.S.

CHAPLAINS' BRANCH.

C. of E.—Rev. C. F. Colin, B.A.; J. H. K. Dagger, M.A.; E. W. L. May, M.A.; T. R. Quin, B.A.; H. L. O. Rees, B.A.; C. B. Verity, M.A.

U.B.—Rev. W. A. Clynes.

R.A.F. REGIMENT.

Group Capt. F. J. A. Tanner.

Wing Cdr. H. Sullivan.

Sqn. Ldrs. M. Clark; A. G. Douglas, M.C.; G. R. M. Moses.

Flt. Lt. W. Greensword.

F/O. S. J. S. Herbert.